



United  
States  
Steel  
Corporation

TF-70

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PITTSBURGH, PENNSYLVANIA 15230

September 17, 1976

Mr. Basil G. Constantelos  
Chief, Compliance and Engineering Section  
U. S. Environmental Protection Agency  
Region V  
230 South Dearborn Avenue  
Chicago, Illinois 60604

Gary Works NPDES Permit

Dear Mr. Constantelos:

Enclosed is a copy of our report on the Gary Works Water Pollution Control Program. This material provides a detailed description of the program discussed with EPA and the State of Indiana on August 19, 1976. We have made every effort to answer all of the questions raised at that meeting and during subsequent discussions. The engineering and research data included in this material represent essentially all of the technical information on the program that is available at this time.

As suggested in my letter of August 31, 1976, we will be available for a technical meeting to review this material with you and the State of Indiana at your earliest convenience.

Very truly yours,

*W. E. Jackson*

WEJ:mjh

Attachment

cc: Oral H. Hert  
State of Indiana

Dist. by RHC 9/20/76:

McDonald  
Bryson  
Romanek

Ginsberg w/attachment  
Constantelos w/attachment  
Regional Counsel

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### ATTACHMENTS

1. Brown and Root, Inc. - Proposal
2. W. T. Patterson Company, Inc. - Proposal
3. Figure A-1 - Flow Schematic for Gary Works Blast Furnace Recycle System
- 4A. Critical Analysis of Construction Time
- 4B. Figure 1 - Blast Furnace Recycle System - Design and Construction Schedule
5. Detailed Explanation of Design and Construction Schedules
6. Evaluation of Air Stripping as a Means of Reducing the Ammonia - Nitrogen Content of Blast Furnace Recycle Water Blowdown at Gary Works
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13. Nalco Proposal - "Investigation of Coke Plant and Sinter Plant No. 3 Waste Discharges to Determine Point Sources Origin and Contaminant Loadings"
14. Betz Proposal - "Comprehensive Study of Gary Works Outfalls GW-6, GW-7, GW-13, GW-L1, GW-L1A and STL-5."
15. Memorandum - Gary Works Environmental Control Dept.

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UNITED STATES STEEL CORPORATION

GARY WORKS

WATER POLLUTION CONTROL PROGRAM

12594



UNITED STATES STEEL CORPORATION  
GARY WORKS  
WATER POLLUTION CONTROL PROGRAM

This report has been prepared in response to a request by the US EPA and State of Indiana representatives in a meeting in Chicago on August 19, 1976 and a subsequent meeting on August 26, 1976. The material herein describes the various aspects of the facility program being developed for Gary Works resulting from negotiations regarding the NPDES permit issued June 25, 1976.

The following list of subjects which are discussed in detail:

- I. Description of Facility Program and Blast Furnace Recycle System Blowdown Treatment.
- II. Coke Plant and Other Cooling Water Sewer Investigations.
- III. Interim Process and System Improvements by July 1, 1977.
- IV. Projected Water Quality Resulting from the Facility Program.

I. FACILITY INSTALLATIONS

1. Blast Furnace Recycle System - Outfall (017) - CW-5

A. Project Description

The blast furnace process water presently receives treatment in scalper-clarifiers and a settling basin on a once-through basis. Polymer addition and sludge recirculation are also used in the treatment process. The general concept of the blast furnace recycle system includes the pumping of the water from the settling basins over a cooling tower to the furnaces. The piping on the furnaces will be changed so that the non-contact cooling water and process water will be separated, the cooling water being prevented from entering the recycle system. The furnaces will be provided with facilities so that the recycle water will first pass through the gas cooler to a sump and then be repumped through the gas cleaning device and discharged to the dirty water sewer for treatment and recycling.

In addition, three banks of blast furnace gas wet electrostatic precipitators and the blast furnace gas drains and seals (drip legs) will be connected to the process water system to be resupplied with recycled water.

A separate recycle system will be provided for the No. 1 bank of precipitators that are used to clean blast furnace gas for coke oven battery underfiring.



B. Status of Field Investigation

Essentially all of the field investigation required to scope this project from a flow standpoint is complete. Required field investigation for the purpose of design is the responsibility of the engineering contractor.

C. Status of Engineering

Pre-authorization engineering for this project has been divided as follows between two outside engineering contractors.

Brown and Root, Inc. has been placed under contract on order 535-98479 based on its proposal of August 2, 1976 (Attachment 1) to perform the preliminary engineering on the supply and distribution piping, etc. for all of the furnaces, gas line seals, precipitators and separate recycle system for No. 1 bank precipitator.

R. T. Patterson Company, Inc. has been placed under contract on order 535-98481 based on its proposal of August 2, 1976 (Attachment 2) to perform the preliminary engineering on the recycle facilities such as hot and cold well pumping, cooling tower, sludge thickener and underflow dewatering facilities.

D. Specific Project Scope

The scope of work for recycle of the process water at the Gary Works blast furnaces is extensive. It is comprehended that eight (8) of the (one through twelve) blast furnaces will be operating at the time the recycle system is installed. The eight furnaces are expected to be Nos. 4, 6, 7, 8, 9, 10, 11 and 12; however, the capacity of the system will be designed to handle the process water from 12 furnaces or 20,000 tons per day of hot metal capability. It will also be necessary for the system to accommodate miscellaneous flows from various auxiliary facilities in the blast furnace area which are required in support of the blast furnace operation.

Sewer GW-5 is the only process sewer in the blast furnace area. It accommodates stockhouse and ore yard drainage, central treatment and boiler blowdown from the blast furnace boiler house, backwash from the service water strainers on the furnaces, once through water from No. 1, 2, 3 and 4 wet electrostatic blast furnace gas precipitators, and process water from the gas cleaning and gas cooling facilities on each blast furnace. In addition there is some clean cooling water being discharged via outfall CW-5.

To the best of our knowledge, only indirect cooling water from the furnace shell, tuyeres, etc., is discharged via outfall GW-6. It is anticipated that the proposed recycle system for blast furnaces (one through twelve) will be required to process approximately 50 mgd and generate a blowdown volume of 4 mgd which will be treated by an alkaline chlorination system described later in the report.

Figure A-1 (Attachment #3) "Flow Schematic for Gary Works Blast Furnace Recycle System" is provided for purposes of outlining the flow details of the process water recycle system volume and blowdown requirements. As indicated on the schematic the water treatment facility will receive flow from six sources.

An explanation of each source follows.

Electrostatic precipitator banks No. 2, 3 and 4 are used to clean blast furnace gas used for boiler and stove fuel and No. 1 bank recleans gas for coke oven battery underfiring.

As the quality of gas from the blast furnaces improves in the future, due to improved scrubbing at the furnaces, it is expected that banks No. 2, 3 and 4 will gradually be phased out; however, bank No. 1 will remain in service.

Based on these facts and the more stringent gas cleaning requirements for battery underfiring, bank No. 1 will be equipped with its own recycle system having a "blowdown" of approximately 25% or 1.1 mgd (flow No. 1 - Figure A-1) to the process water system with make-up coming from service water.

Due to the presence of high dissolved solids, the "blowdown" from No. 1 bank precipitator recycle system is not expected to be of a quality that can be used as make-up for the main recycle system. However, the suspended matter it contains will be removed in the main recycle treatment facility.

Due to the limited future life for banks No. 2, 3 and 4, and a lesser gas cleanliness requirement they will be operated on main recycle system water. Intermittent addition of service water will be used as flush water to control scale deposits in the precipitators (Flow No. 2 - Figure A-1). Flow from this facility is estimated at 6.4 mgd.

Flow No. 3 on Figure A-1 (0.4 mgd) represents the blowdown from the blast furnace gas boiler house feedwater treatment facility and blowdown from the boilers themselves. This water contains suspended solids which will be removed in the main treatment facility. However, due to the high dissolved solids, it cannot be used as make-up in the main recycle system.



Flow No. 4 on Figure A-1 (estimated at 0.6 mgd) is the backwash from the service water strainers throughout the area. This water contains suspended matter but is of a quality that can be used as main recycle system make-up.

Flow No. 5 on Figure A-1 (estimated at 0.9 mgd) is variable because it is directly affected by rainfall. This includes stockhouse and skip pit infiltration and drainage as well as drainage from the ore yard and the general area. It is conceivable that under certain conditions the contribution from these sources may be of a volume that could, for a short period of time, require a blowdown rate in excess of 4.0 mgd. The quality of this flow is expected to be such that it can effectively be used as make-up in the recycle system.

Flow No. 6 on Figure A-1 (estimated at 40 mgd) represents the process flow from the gas cooling and gas cleaning facilities on each blast furnace. It is expected that blowdown from the recycle system will be required at the rate of 125 gallons per ton of iron production or 2.5 mgd ( $20,000 \text{ TPD} \times 125 \text{ GPT} = 2.5 \text{ mgd}$ ). This 2.5 mgd volume of blowdown is associated with the actual blast furnace operation; however, due to the other factors described above, the actual volume entering the blowdown treatment facility will approximate 4 mgd which will contain blast furnace chemistry in amounts representative of 20,000 TPD operation at Gary Works.

In summary, the 4 mgd blowdown is made up of 2.5 mgd from the main recycle blowdown, 1.1 mgd from No. 1 precipitator system high dissolved solids blowdown, and 0.4 mgd of high dissolved solids water from the boiler house.

Fresh water make-up is supplied by flows No. 4 and No. 5 on Figure A-1 and intermittently through No. 2, No. 3 and No. 4 precipitator flush water, with the final make-up expected to occur at the main recycle system pumphouse.

The scope of work includes but is not limited to the following facilities and components.

1. New and changed piping at each furnace, including sumps, standpipes, and pumping installations, to permit repumping of gas cooling water to gas cleaning service and discharge it to process sewer GW-5. Make necessary piping changes or additions on each furnace to separate clean cooling water from process water and direct the clean cooling water to GW-6.
2. Replace existing clean water sewer on each furnace by installation of a new lateral (approximately 200 feet of 36" sewer at each furnace) to provide adequate capacity to convey the increased volume of cooling water to GW-6.



3. Collect all blast furnace gas main seal drips and bleeder stack drains (all located within 150 feet of the blast furnaces on the west side) and direct them to the process water sewer. Estimated 25 sources at 50 gpm each.
4. In the area of the present scalper-clarifier-settling basin complex, the major equipment to be installed will be a hot well pump station, a multi-cell cooling tower, a cold well pump station, and substation facilities, as well as a sludge thickener, vacuum filter sludge dewatering facilities, various buildings to house much of this equipment, and incoming power and utilities.
5. Install approximately 4800 feet of large diameter pipeline from the cold well pumps to the vicinity of No. 11 and No. 12 furnaces as the main return water line. The scope comprehends running this pipe underground east of the blast furnaces.
6. Install connections between the large diameter pipeline and the furnaces that will be operating. This will require approximately 200 feet of 12" diameter pipe at each furnace in addition to numerous connections, fittings, etc.
7. Install approximately 4000 feet of pipe to resupply the blast furnace gas main seal drips, and No. 2, 3 and 4 precipitator stations from recycle header.
8. Provide separate 3.3 mgd recycle system for No. 1 precipitator station.

E. Design and Construction Schedule

A detailed description of the complexities of construction of four major elements in this project and a critical analysis of the construction time requirements is presented in Attachment 4-A.

A bar chart design and construction schedule for this project is also attached and identified as Figure 1, Attachment 4-B. Attached to the bar chart (Attachment 5) is a detailed explanation of the design and construction schedules for each facility element discussed in the whole report.

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2. Blast Furnace Recycle System Blowdown Treatment (Outfall 017) CW-5  
Project Background

The 4.0 mgd blowdown from the blast furnace recycle system will be treated by a process defined by EPA as the best available technology economically achievable (BATEA). The process is a sequence of (1) alkaline chlorination, (2) pressure filtration, and (3) carbon adsorption.

In the preliminary investigation of the effectiveness of this treatment method for the Gary Works Blast Furnace blowdown, United States Steel believed that the final effluent quality with minimum impact on the receiving stream, could best be accomplished by air stripping the water to remove most of the ammonia nitrogen, and then applying the EPA recommended system of alkaline chlorination.

It was initially reasoned that air stripping would be capable of reducing the anticipated ammonia-nitrogen level from 100 milligrams per liter (mg/l) to about 10 mg/l, and that the reduced chlorine requirement would lessen the load of chloride ion to the Grand Calumet River. However, following a survey of the pertinent literature and an evaluation of bench-scale studies, United States Steel has concluded that air stripping is impractical for Gary Works.

Specifically the conclusions may be summarized as follows:

1. Severe technological problems would be encountered.
2. Energy requirements would be excessive.
3. The complexities of the project would require substantially longer development time.
4. Process costs would be excessive.

A separate document titled "Evaluation of Air Stripping as a Means of Reducing the Ammonia-Nitrogen Content of Blast-Furnace-Recycle-Water Blowdown at Gary Works" is attached (Attachment 6) in support of these conclusions.

Bench scale studies of the alkaline chlorination system for purposes of establishing the treatability of the blowdown based on samples of water from the South Works Recycle System have been underway for some time. A separate document titled "Alkaline Chlorination and Carbon Treatment of Blast Furnace Recycle Blowdown at Gary Works" (attachment 7) describes the progress being made on this project.

It in general leads to the following conclusions regarding treatability.



The results of continuous chlorination-dechlorination bench-scale tests to date show the simulated air stripped blast furnace recycle water blowdown to be amenable to treatment. Residual ammonia-nitrogen concentrations of 2 mg/l and residual phenol of 0.05 mg/l could be attained as long term averages. However, residual cyanide concentration is dependent on the concentration of refractory cyanides present in the water being treated because these refractory cyanides are not affected by the treatment. In samples of ammonia-reduced blowdown water, refractory cyanides appear to be about 20 percent of the total cyanides. Over the long term, cyanides in the treated blowdown are expected to average about 1.3 mg/l.

Continued bench-scale studies are necessary to determine the conditions for destruction of cyanate. It is believed that cyanate can be removed by a two-stage chlorination wherein the second stage reaction is conducted at a pH of 7 to 7.5. This pH would favor an increased reaction rate for the oxidation of cyanate to nitrogen and carbon dioxide.

Bench scale test results strongly suggest that oxidation-reduction potential (ORP) may be applicable to control the break point chlorination. The specific ORP for operating first and second stage reactions must yet be determined. Further studies are required to verify the dependability of ORP to control break point chlorination. This is a critical element of the treatment process.

Although only simulated air-stripped blowdown has been studied to date in the continuous system, from the results of earlier batch tests (Table C-2) on raw blowdown water, it is believed that the higher concentrations of  $\text{NH}_3\text{-N}$  will pose no more of a problem than the air-stripped blowdown. A higher chloride-loading in the treated water would, however, be expected. The continuous chlorination-dechlorination of raw blowdown water is planned for continued bench-scale studies.

The next step in the development of the full scale alkaline chlorination treatment system is the installation of a pilot plant facility.

Concurrent with continuing bench-scale studies, the construction and operation of a 0.33 gpm continuous chlorination-dechlorination pilot unit is planned at USS South Works. Operation of a pilot unit is required to accomplish the following:

- a. Field testing to determine results obtainable on treating a freshly generated variable-composition blowdown.
- b. Determine the applicability of ORP as a method for automatic chlorine feed control for breakpoint chlorination.
- c. Optimize reaction conditions (reaction times and pH) for chlorination.
- d. Continuous long-term operation to determine carbon usage rate.



- e. Determine optimum conditions for carbon treatment, i.e., contact time and linear velocity.
- f. Long term operation for corrosion testing.
- g. Carbon regeneration studies to determine carbon losses on regeneration.

The foregoing information will be necessary to provide plant scale design parameters such as vessel and line sizing, type of control instrumentation, chemical requirements, carbon and column requirements, method of carbon regeneration, type of construction materials, and finally, space requirements.

A time frame is proposed that will encompass a period through December 1976 for design and construction of the pilot plant. Operation of the pilot unit will begin in December and continue until mid June of 1977.

#### Project Development

Due to the developmental nature of this project at this time there has been no engineering on the full scale facility. Based on the general concept of the type of blowdown treatment facility that is contemplated, the attached bar chart design and construction schedule Figure 2 (attachment 8) has been developed for a full scale facility.

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3. Bar and Structural Mills Pickling Plant Outfall (033) ST-14

A. Project Description

Presently, waste pickle liquor and rinse water from the Bar and Structural Mills is discharged on a batch basis from the pickling plant to two lagoons for disposal. These lagoons have no known outlet and it is believed that they adversely affect the water quality in outfall ST-14.

In order to discontinue the present practice, it is comprehended that the waste pickle liquor will be collected and pumped to a storage tank for disposal in the Gary deep well. The rinse tanks will be converted from batch to continuous discharge and the rinse water overflow will be collected and pumped to the Terminal Lagoons via sewer GW-12.

B. Status of Field Investigation

No further field investigation is required to scope this project from a flow standpoint. Required field investigation for the purpose of design is the responsibility of the engineering contractor.

C. Status of Engineering

Engineering for this project is to be provided by Boynton Engineers based on its proposal of August 20, 1976, (attachment No. 9) on USS Purchase Order 535-98568.

D. Specific Project Scope

The waste pickle liquor disposal system will collect waste acid from two tanks located at the north end of the Bar and Structural Mills Pickling Plant and from three tanks located at the south end. The waste acid from the north end of the plant will be pumped south and out to the waste pickle liquor storage tank. The waste acid from the south end of the plant will be pumped directly to the waste pickle liquor storage tank. The waste acid will be disposed of in the Gary deep well.

Three rinse tanks are located at the north end of the plant and two at the south end. These rinse tanks will be converted from batch to continuous discharge. The overflow from the north rinse tanks will be collected in a sump and pumped to the south end of the plant into sewer GW-12. The overflow from the south end rinse tanks will flow directly to a sump and be pumped to GW-12.

This flow will then combine with the existing flow in GW-12 which discharges via a pump station to the Terminal Lagoons.

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D. (Continued)

The scope includes the following major items:

1. Acid resistant pumps and piping to collect the waste pickle liquor. Four 250 gpm pumps and 400 feet of piping are estimated.
2. An acid resistant waste pickle liquor storage tank.
3. Four 200 gpm pumps and 1200 feet of pipe are required for the rinse water.

E. Construction Schedule

A bar chart design and construction schedule (Figure 3) (Attachment 10) for this project is attached.

4. Electrolytic Tinning Lines - Outfall (034) ST-17

A. Project Description

There are three Electrolytic Tinning Lines at Gary Works. They are patented U. S. Steel process facilities which use an electrolyte which contains dissolved tin and phenol and employs an evaporation system to control the plating solution concentration. Solution lost through line leakage, plating solution carry-out and evaporator carry-over receives treatment at the Terminal Treatment Plant prior to discharge through ST-17. This treatment removes tin by chemical precipitation; however, does not remove phenol. A recycle system will be installed at the Tinning Lines to eliminate this discharge to the Terminal Treatment Plant.

B. Status of Field Investigation

Field investigation is essentially complete and the process design is being developed by U. S. Steel Research.

Field investigation for purpose of design is the responsibility of the engineering contractor.

C. Status of Engineering

Engineering for this project is to be provided by Boynton Engineers based on its proposal of August 20, 1976, (Attachment No. 9) on USS Purchase Order 535-98568.

D. Specific Project Scope

The project consists of a sink roll seal collection system, evaporator modification for the three electrolytic lines, and evaporator condensate recycle system. Electrolyte losses will be collected from the plating and the circulating pump area. They will be segregated

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D. (Continued)

from all other process water and will be transferred to a holding tank. This collected material will then be pumped through a pressure filter to remove any accumulated tin sludge and insoluble impurities and returned to the electrolyte systems.

The evaporators will be modified to permit recycle of the normal carryover of phenol and thereby eliminate its discharge. The existing water eductors create a vacuum in the evaporators and condense the water-phenol vapor by direct contact with water, which flows directly to the sewer. By changing this existing direct-contact system to indirect cooling and by installing mist eliminators and recycling the resultant small volume of condensate to the dragout rinse tank, the discharge of phenol from the system will be minimized.

The scope of work for the three electrolytic tinning lines includes the following:

1. Collect and recycle electrolyte losses and recover tin by installing a collection system to contain electrolyte. Install a pressure filter to clean and reuse the electrolyte and to permit salvage and recovery of tin from the filter cake.
2. Existing electrolyte evaporators will be modified to eliminate the discharge of contaminated condensate to the sewer. This will be accomplished by:
  - a) Replacing existing eductors (barometric condensers) with indirect water cooled condensers and steam ejectors.
  - b) Install demisters to prevent overhead carry-over of non-volatiles.
  - c) Install new sump, pumps, piping, etc., to recycle condensate to the drag-out rinse tank.

E. Construction Schedule

A bar chart design and construction schedule (Figure 4) (Attachment 11) for this project is attached.

5. Chrome Control - Electrolytic Tinning & Tin Free Steel Lines - Outfall (034) ST-17

A. Project Description

The chrome plating rinse water from the No. 1 Tin Free Steel Line and the flow from the dichromate tanks on each of the three electrolytic tinning lines currently receive treatment at the Terminal Treatment Plant prior to discharge through ST-17. The flow in the

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A. (Continued)

sewer system is at a low pH and contains sufficient ferrous iron to normally permit the reduction of hexavalent chrome to trivalent chrome. To assure that this reduction takes place, a facility will be installed in the electrolytic tinning line area to control pH and ferrous iron concentration.

B. Status of Field Investigation

Field investigation is essentially complete and the process design is being developed by U. S. Steel Research. Field investigation for the purpose of design is the responsibility of the engineering contractor.

C. Status of Engineering

Engineering for this project is to be provided by Boynton Engineers on its proposal of August 20, 1976, (Attachment No. 9) on USS Purchase Order No. 535-98568.

D. Specific Project Scope

The chrome plating rinse water from the No. 1 Tin Free Steel Line and the intermittent flow from the dichromate tanks on each of the three electrolytic tinning lines will be collected and diverted to a reduction-precipitation treatment process. Facilities will be provided at the tin free steel line to collect the chrome rinse water and at the electrolytic tinning lines to collect the spent dichromate solution. The collected flow will be reacted with ferrous iron in waste pickle liquor in a tank with sufficient residence time to permit the chemical reduction of hexavalent chrome to trivalent chrome. This stream will then enter the existing tin mill sewer to the terminal treatment plant. The increase in the pH by the addition of lime which is normal practice at the terminal treatment plant results in the precipitation of chrome and other metals. The scope of work comprehends the following:

1. Refurbish pit under the Tin Free Steel Line to contain plating solution. Provide control system alarm and transfer pumps to automatically return solution from the pit to the idle circulating tank.
2. Redesign roll-seal drain system on tin free steel plating bath to return chrome solution to the circulation tank.
3. Install collection system under chemical treatment dichromate tanks on each of the three electrolytic tinning lines.
4. Provide waste pickle liquor storage and handling facility.

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5. Install reaction tank to provide sufficient residence time for chemical reduction of hexavalent chrome to trivalent chrome.
  6. Install treated effluent pump facilities.

#### E. Construction Schedule

A bar chart design and construction schedule Figure 5 for this project is attached. (Attachment No. 12)

## II. Coke Plant and Other Cooling Water Sewer Investigations

The professional services of Nalco Environmental Sciences and Betz Environmental Engineers, Inc. have been engaged on U. S. Steel Orders 535098574 and 535-98548 to provide comprehensive studies of various cooling water outfalls at Gary Works. Their studies are being undertaken because to the knowledge of U. S. Steel personnel there are no connections to these outfalls that could account for the presence of various chemicals including suspended matter and oil and grease in amounts or concentrations exceeding those found in the intake water.

Specifically (15) fifteen representative days of sampling will be conducted by Nalco on Coke Plant outfalls GW-1, 2, 3, 4 and the Coke Plant pump house and by Betz on GW-6, 7, 13, L-1, L-1-A, and STL-5 and central pump houses 1 and 2. The work scope is designed to establish flows in the above outfalls and to determine the quality of the effluent and essentially the point source origins, where applicable of the total suspended solids, phenol, ammonia, total cyanide and oil and grease detected to be present in the outfalls. All of the intakes will be sampled for all of these parameters.

Complete details of the Nalco study are contained in their proposal 76-224-C dated August 11, 1976, and titled "Investigation of Coke Plant and Sinter Plant No. 3 Waste Discharges to Determine Point Sources Origin and Contamination Loadings" and transmittal letter of the same date and a scope revision letter of August 18, 1976. (Attachment No. 13)

Similar information regarding the Betz study is contained in their attached August 13, 1976, "Comprehensive study of Gary Works Outfalls GW-6, GW-7, GW-13, GW-11, GW-11A and STL-5" proposal R358-76-2-1-MV. (Attachment No. 14)

Field investigation is expected to commence on each of the projects, which will be conducted simultaneously, during the week of October 3, 1976. It is estimated that a total elapsed time of three months may be required before confirmed results are forthcoming. Further an additional period of three months or more may be required to physically examine the sources of contamination if any are located. Due to the completely unknown nature of any discovery it is not possible at this time to make an assessment as to the type of correction, if any, that may be required or the time of construction to accomplish it.

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### III. Interim Process and System Improvements by July 1, 1977

Gary Works has developed an Environmental Control Program that brings together an expanded staff of management and technical personnel having the primary function of developing advanced procedures for the operation, maintenance, and fine tuning of water pollution control facilities presently operating at Gary Works. The program is also directed toward development of improved operating procedures at all process facilities where potential for water contamination exists. This combined effort of improved reduction from existing control facilities and improved measures to prevent contamination have already resulted in reduced discharges over the past several years. A description of the program with specific examples is contained in Attachment No. 15.

Based on a continuation of this effort, it has been projected that the following outfalls can achieve the July 1, 1977 limits as given in the NPDES permit issued on June 25, 1976: 002 (GW-1), 020 (GW-7A), 028 (GW-10A), 030 (GW-11A), 034 (ST-17), and 039 (STL-6).

The facility modification program as outlined in section one will have been completed on three of the blast furnaces by July 1, 1977. Blast Furnaces No. 4, 6, and 7 will have been shut down, relined, modified, and restarted by July 1, 1977. Blast Furnace No. 10 will have been shut down in preparation for reline by the above date.

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#### IV - Projected Water Quality Resulting From Facility Program

At meetings held in Chicago on August 19 and 26, 1976, data were submitted to the US EPA and the State of Indiana describing the present and projected discharges of Gary Works' outfalls to the Grand Calumet River. At that time, these agencies requested that a more detailed account of the data be submitted. Therefore, this report constitutes an elaboration of the data previously submitted.

##### Present Discharge Data

The description of the present discharge is presented in Tables I through III. Table I contains the data relating to ammonia-N, phenol and cyanides, while Table II contains the total suspended solids data. Both of these tables present the data on an outfall by outfall basis. Finally, Table III represents a summation of the mean values presented in Tables I and II and is presented in a form such that the data are combined according to production areas.

##### Ammonia-N, Phenol and Cyanide - Table I

The data shown for outfalls GW-1 through GW-5 and the River at the PRR Bridge (PRR), represent Gary Works' data for the period January 1975 through April 1976. The daily averages (95-5) and daily maximums (95-1) were statistically derived from this data base.

Since no Gary Works' data were available for outfalls GW-6 through ST-17, the mean values for these outfalls were based on Combinatorics data. In order to calculate daily averages and maximums, it was necessary to make several assumptions.

First, it was assumed that the ammonia-N distribution and variability for these outfalls were the same as that of GW-5. The ratio of the daily average to the mean was 1.35 and the ratio of daily maximum to the mean was 1.9 for GW-5. Thus, the daily averages and daily maximums for ammonia-N for these outfalls were calculated by multiplying the means by 1.35 and 1.9, respectively.

Second, because the distribution of the phenol and cyanide data for GW-5 was uncertain, and because of the variability of the data for these two parameters, it was decided not to use the ratios for these parameters for GW-5 to calculate the daily averages and daily maximums for these outfalls. Rather, the daily averages and maximums were calculated by multiplying the mean by 2 and 3, respectively.



Finally, the total of the discharges represents a summation of the data for the individual outfalls.

Net means were determined for the data for the total of the discharges and for the PRR by assuming that lake-quality water contains 0.834 lb ammonia-N, 0.008 lb phenol, and 0.033 lb cyanide per million gallons. These values were based on the City of Chicago's survey of Lake Michigan for the period March 19, 1975 through April 21, 1976. Here, to determine the net daily averages and maximums, it was assumed that the distribution and variability were the same as with gross data. Therefore, the data were calculated as follows:

$$\frac{\text{Gross daily average (or daily maximum)}}{\text{Gross mean}} \times \text{Net mean} =$$

Net daily average (or daily maximum)

#### Total Suspended Solids - Table II

The total suspended solids (TSS) data shown on Table II represent Gary Works' data for the period July 1974 through June 1976. The gross daily averages (95-5) and the gross daily maximums (95-1) were statistically determined. The net mean values were calculated by assuming that lake-quality water contains 41.7 lb TSS per million gallons. The distribution and variability of the net data were assumed to be the same as the gross data. Therefore, the net data were calculated as follows:

$$\frac{\text{Gross daily average (or daily maximum)}}{\text{Gross mean}} \times \text{Net mean} =$$

Net daily average (or net daily maximum)



Projected Discharge Data for Gary Works  
Grand Calumet River Outfalls

The discharges anticipated when control facilities are installed at Gary Works are presented in Tables IV through VIII. The facilities include blast-furnace (BF) recycle with alkaline-chlorination blowdown treatment, treatment facilities for ST-17 and improvements in the coke-plant area. In Table IV, the data pertaining to ammonia-N, phenol and cyanide are presented, whereas Tables V, VI, and VII contain the data relating to the BF facilities. Last, Table VIII presents a compilation (with respect to production areas) of the mean values presented in Tables IV and VII.

Ammonia-N, Phenol and Cyanide - Table IV

Where installations or improvements in the discharge quality are expected, the values presented in Table IV represent the data on an outfall by outfall basis. Where no change in the discharge data is anticipated, the data are combined and are presented for a given production area.

For the coke-plant sewers, viz, GW-1 through GW-4, it is projected that with improvements that one-half the ammonia-N, phenol and cyanide, in the present discharges (January 1975 through April 1976 data base), above lake-quality water will be removed. Again lake-quality water (background) is assumed to contain 0.834 lb ammonia-N, 0.008 lb phenol, and 0.033 lb cyanide per million gallons. Thus, the projected gross mean values were calculated as follows:

$$\frac{\text{Present gross mean less background}}{2} + \text{background} = \text{projected gross mean}$$

The projected gross daily average and gross daily maximum were calculated by assuming the same statistical distribution and variability as noted with the gross data for present discharges. Also included in the projections for the coke-plant area was a discharge of 30 million gallons per day (mgd) of cooling water (background) needed for projected future coke-production. Here, with the cooling water, because the variability and distribution of the data are not known, the ammonia-N daily average and daily maximum were estimated by multiplying the mean by 1.35 and 1.9, respectively; for phenol and cyanide the daily averages and daily maximums were estimated by multiplying the mean by 2 and 3, respectively (Table IV). 12611

The projected data presented here for GW-5 are presented in detail in a following section on alkaline-chlorination of BF recycle water.

In the BF nonprocess-water area (GW-6 and 7), no change in these discharges is expected, except for the inclusion of 57.0 mgd of BF cooling water formerly discharged through GW-5. It is assumed that this added water is lake-quality water. The daily average and daily maximums were calculated, as above, with the cooling water in the coke-plant area.

In the sheet and tin area (ST-17), facilities are to be installed to reduce the discharge of phenol. From experience in other such installations, it is expected that the 22.5 pounds of phenol presently discharged through ST-17 will be reduced by 18 pounds. The daily average and daily maximum for phenol were calculated, as before, by multiplying the mean by 2 and 3, respectively.

Last, the remaining discharges (7A, 9, 10A, 11A, 13, 14) are assumed now to contain only lake-quality water. Again, the daily averages and daily maximums were calculated, as above, with the cooling water in the coke-plant area.

The gross data for the total of the discharges are a summation again of the data for the individual outfalls.

A comparison of the present discharge data (presented in Table I), total of the discharges vs PRR, shows that the data are dissimilar. For example, the ammonia-N mean at the PRR is larger than the mean for the total of the outfalls whereas the reverse is true when the phenol means are compared. Therefore, for the projected data at the PRR to be comparable to that of the total of the discharges, it was necessary to make certain adjustments.

For ammonia-N, the mean, daily average and daily maximum at the PRR were greater than the total of the discharges by 895, 928, and 931 pounds, respectively. Thus, to calculate the projected ammonia-N data at the PRR, the values for the total of the discharges were increased by these respective amounts.

However, the lower means, for instance, for phenol and cyanide at the PRR compared to the total of the discharges might be expected, in part, because of degradation. Therefore, for these two parameters, the adjustment was only a percentage of the difference noted, e.g.

$$\frac{\text{Phenol, mean (total of discharges)} - \text{phenol, mean (PRR)}}{\text{Phenol, mean (total of discharges)}} =$$

$$\frac{237-122}{237} = 48.5\%$$

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Thus, for phenol and cyanide, to calculate the data at the PRR, the data for the total discharges were decreased by the following percentages:

		<u>Mean</u>	<u>Daily Average</u>
Phenol	(-)	48.5%	(-) 24.25%
Cyanide	(-)	36.6%	(-) 18.3 %

The daily averages were decreased by only one-half the percentage that the means were decreased because of the uncertainties in the data distribution and variability. Because of uncertainties in the distribution of the data and variability in the data, no adjustments were made to either daily maximum.

The net data for the total of the discharges and the PRR were calculated in the manner described above (see description under the present discharge section).

#### Total Suspended Solids

The total suspended solids (TSS) data for the outfalls remain the same as the present discharge except for GW-5. For GW-5, a decrease in TSS as a result of recycle has been covered in a latter section on alkaline chlorination. However, the additional 30 mgd cooling water in the coke-plant area and the 57.0 mgd cooling water previously discharged through GW-5 must be accounted for. These waters are assumed to be lake-quality water and, therefore, contain 41.7 pounds TSS per million gallons. The projected mean TSS data are compiled in Table VIII. Also included in Table VIII are the projected mean values for ammonia-N, phenol and cyanide (from Table IV), the mean values for all parameters for GW-5 (from Table VII), and the mean values for sulfate, chloride and fluoride. The sulfate, chloride, and fluoride values (excluding those for GW-5) are based on very limited data from 1971 through 1974.

#### Chloride and Sulfate Waste Loads in Gary GW-5 After Alkaline Chlorination of Wastewater from Blast-Furnace-Gas Scrubbers in Recycle Operation

Since a typical recycle water is not presently available from Gary Works blast furnaces, a projected composition (Table V) was estimated, based on the composition of South Works recycle water, and the known current ammonia, cyanide, and phenol contents of the present unrecycled wastewater at Gary Works. The projected composition was based on an anticipated blowdown of 4.0 million gallons per day.

The chlorine-consumption equations for most of the major constituents in blast-furnace gas-scrubber water are given in Table VI. The chlorine demand for the projected blowdown was calculated by using the chlorine consumption values for the individual species given in Table VI. It was assumed that an addition 10 percent of the calculated total chlorine used, based on known chlorinateable species other than ammonia, would be consumed by other unidentified oxidizable species in the blowdown water.

Chlorine consumption values were calculated for a blowdown having a long-term average  $\text{NH}_3\text{-N}$  content of 3222 pounds per day (Table VII), or a daily average (L-4)  $\text{NH}_3\text{-N}$  content of 4320 pounds per day. Also included in these tables are the corresponding chloride and sulfate waste loads that would be carried in the effluent in each instance.

Chloride (678 mg/l), sulfate (302 mg/l) and suspended solids (50 mg/l) values projected for the Gary Works blowdown are based on the quantities present in South Works' blowdown water. The fluoride value (16 mg/l) is based on five pieces of data from GW-5 over a period from 1971 through 1974.

The mean levels of ammonia, phenol, and cyanide in the discharge are based on estimates from preliminary bench-scale chlorinations of typical South Works' blowdown waters. Daily average and daily maximums for these components were calculated based on the existing statistical distributions in GW-5 outfall water. Fluoride ion is projected to remain at 16 mg/l in the discharge water because it is not expected to be affected by the chlorination reaction. The suspended solids value of 10 mg/l is based on the best estimate for current filtration technology. In the case of both fluoride ion and suspended solids, the daily average and the daily maximum for each were calculated by multiplying their mean values by 2 and 3, respectively.

The chlorides and sulfates in the projected discharge are derived from two sources. The chloride and sulfate originally in the recycle blowdown before chlorination are converted to daily averages and daily maximums by the use of the factors 2 and 3, respectively. Additional chlorides and sulfates are formed in the alkaline chlorination process, and these are statistically treated by assuming the same distribution factors that ammonia has for the daily average and daily maximum. As a result, sulfates and chlorides have hybrid distribution factors. The projected discharge data are presented in Table VII.



### Summation of Data

Finally, a summation of all the data, both present and projected, are presented in Table IX. Compared in the table are the data for the total of the outfalls with that at the PRR. Both gross and net means, daily averages and daily maximums are presented.

The ammonia-N, phenol and cyanide data are taken from Tables I and IV.

The present TSS data are taken from Table II. For the projected TSS data, it was assumed that the distribution for the present data also applies here. The projected gross mean of total of the outfalls represents a summation of the data for the individual outfalls (Table VIII). Starting with this projected gross mean, all other projected gross data are in proportion to that for the present discharge. For the net values, the projected net means were first calculated and, then, the rest of the net data were proportioned to correspond with the present net average and maximum.

Finally, because of the paucity of sulfate, chloride and fluoride data for the present discharge, no effort was made to show a difference between the present and the projected data for sulfate, chloride and fluoride. Nonetheless, projected mean values (gross and net) for these parameters were developed (Table VIII). Because of the paucity of data and uncertainty of the distributions and variabilities, the daily averages and daily maximums were estimated by multiplying the means by 2 and 3, respectively. It was assumed the data for the total outfalls and for the PRR would be the same.

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Discharge	Flow, mgd	Gross or Net <sup>1)</sup>	Ammonia-N, lb/day			Phenol, lb/day			Cyanide, lb/day					
			Mean	Daily Avg	Daily Max	Mean	Daily Avg	Daily Max	Mean	Daily Avg	Daily Max			
Coke Plant Sewers <sup>2)</sup>														
GW-1 (002)	31.2	Gross	273	1.0	583	1,074	7.0	.02	16.5	31	7.4	.03	22.1	45
GW-2 (007)	14.7	Gross	277	2.2	421	663	6.0	.04	12.0	22	3.6	.03	10.5	22
GW-3 (010)	3.5	Gross	37	1.2	71	124	1.0	.03	2.1	3.9	1.4	.04	3.7	7.4
GW-4 (015)	1.4	Gross	5	.4	15	30	0.1	.0085	0.9	1.8	0.1	.008	0.4	0.9
BF Process Water <sup>2)</sup>														
GW-5 (017)	61.0	Gross	3222		4320	6,186	160		243	385	3394		4750	7,073
BF Nonprocess Waters <sup>3)</sup>														
GW-6 (010)	28.0	Gross	49	.2	66	93	1.5	.006	3.0	4.5	2.5	.01	5.0	7.5
GW-7 (019)	22.3	Gross	18	.09	24	34	0.4	.002	0.8	1.2	0.9	.004	1.6	2.7
Steel Production, Bar and Structural Mills <sup>3)</sup>														
GW-7A, and 9 (020, 021)	123.8	Gross	259	.25	350	496	35.7	.034	71.4	107	12.9	.01	25.8	39
GW-10A (025)	128.3	Gross	216	.2	296	408	2.7	.002	5.4	8.1	10.8	.01	21.6	32
GW-11A (030)						9	0.2	.006	0.4	0.6	0.2	.007	0.4	0.6
GW-13 (032)	3.6	Gross	5	.19	7									
ST-14 (033)	2.0	Gross	3	.17	4	6	0.01	.0005	0.02	0.03	0.2	.01	0.4	0.6



Table I (cont'd)

Present Discharge Data for Gary Works  
Grand Calumet Outfalls

Discharge	Flow, mgd	Gross or Net <sup>1)</sup>	Ammonia-N, lb/day			Phenol, lb/day			Cyanide, lb/day			
			Mean	Daily Avg	Daily Max	Mean	Daily Avg	Daily Mean	Mean	Daily Avg	Daily Max	
Sheet and Tin <sup>3)</sup> ST-17 (634)	32.5	Gross	50	19	68	94	22.5	45	68	2.5	5.0	7.5
Total of Discharges <sup>4)</sup>	452.3	Gross	4414	6225	9,211	237	400	633	3437	4858	7,238	
		Net	4037	5693	8,424	233	393	622	3422	4837	7,206	
PRR <sup>2)</sup>	447.4	Gross	5309	7153	10,142	122	242	671	2178	4357	7,869	
		Net	4936	6445	9,422	118	234	649	2163	4327	7,815	

1. Net mean calculated by assuming that lake-quality water contains 0.834 lb NH<sub>3</sub>-N, 0.008 lb phenol, 0.033 lb cyanide per million gallons.
2. Data represents the period, January 1975 through April 1976.
3. Means based on Combinatorics data. The ammonia daily averages and daily maximums calculated as 1.35 x mean and 1.9 x mean respectively. For phenol and cyanide, the daily averages and maximums were calculated as 2 x mean and 3 x mean, respectively.
4. Gross data represent a summation of the data for the individual outfalls.

Table II

Present Suspended Solids Discharge Data for Gary Works  
Grand Calumet River Outfalls

Discharge	Flow, mgd	Gross or Net <sup>1)</sup>	Suspended Solids, lb/day <sup>2)</sup>		
			Mean	Daily Avg	Daily Max
				11,68	21,8
Coke-Plant Sewers					
GW-1	32.7	Gross	4,673 17	7,885	13,040
(002)		Net	3,309	5,583	9,234
GW-2	15.3	Gross	2,107 17	3,314	5,384
(007)		Net	1,469	2,311	3,754
GW-3	3.58	Gross	457 15	1,040	1,977
(010)		Net	308	701	1,332
GW-4	1.62	Gross	226 17	499	938
(015)		Net	158	349	656
BF Process Water					
GW-5	63.9	Gross	9,162	14,310	23,050
(017)		Net	6,497	10,148	16,345
BF Nonprocess Waters					
GW-6	35.0	Gross	3,996 14	6,737	17,990
(018)		Net	2,536	4,276	11,417
GW-7	36.9	Gross	4,192 14	8,715	15,770
(019)		Net	2,653	5,515	9,980
Steel Production, Bar and Structural Mills					
GW-7A and -9	106	Gross	9,825 12	18,540	32,520
(020,021)		Net	5,405	10,199	17,890
GW-10A	38.3	Gross	5,944 19	9,146	14,510
(020)		Net	4,347	6,689	10,612
GW-11A	82.8	Gross	12,160 18	21,460	37,300
(030)		Net	8,707	15,366	26,707
GW-13	6.24	Gross	545 10	1,395	2,758
(032)		Net	285	729	1,442
ST-14	1.65	Gross	374 27	767	1,424
(033)		Net	305	625	1,161
Sheet and Tin					
ST-17	25.3	Gross	3,181 15	5,091	8,365
(034)		Net	1,826	2,922	4,802
Total of Discharges <sup>3)</sup>	449.3	Gross	56,842	98,899	175,026
		Net	37,805	65,413	115,333
PRR	474	Gross	57,270	88,520	115,045
		Net	32,504	55,046	71,540

1. Net mean calculated by assuming that lake-quality water contains 41.7 lb suspended solids per million gallons. Net daily average and daily maximum calculated by using gross value ratios of the daily average (or daily maximum) to the mean.
2. Data represents the period, July 1974 through June 1976.
3. Data represents a summation of the data for the individual outfalls.

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Present Discharge Data for Gary Works—Grand Calumet River Outfalls

<u>Discharge (Outfall No.)</u>	<u>Flow, mgd</u>	<u>Gross or Net<sup>1)</sup></u>	<u>NH<sub>3</sub>-N, Mean, lb/day</u>	<u>Phenol, Mean, lb/day</u>	<u>Cyanide, Mean, lb/day</u>	<u>Suspended Solids, Mean, lb/day<sup>2)</sup></u>
Coke-Plant Sewers (1,2,3,4) <sup>3)</sup>	50.8	Gross	592	14.1	12.5	7,463
	50.8	Net	550	13.7	10.8	5,244
BF Process Waters (5) <sup>3)</sup>	61.0	Gross	3,222	160	3,394	9,162
	61.0	Net	3,171	159.5	3,392	6,497
BF Nonprocess Waters (6,7) <sup>4)</sup>	50.3	Gross	67	1.9	3.4	8,188
	50.3	Net	25	1.5	1.7	5,139
Steel Production, Bar and Structural Mills (7A,9,10A,11A,13,14) <sup>4)</sup>	257.7	Gross	483	38.6	24.1	28,848
	257.7	Net	268	36.5	15.6	19,049
Sheet and Tin (17) <sup>4)</sup>	32.5	Gross	50	22.5	2.5	3,181
	32.5	Net	23	22.2	1.4	1,826
Total of discharges	452.3 <sup>5)</sup>	Gross	4,414	237	3,437	56,842
	452.3 <sup>5)</sup>	Net	4,037	233	3,422	37,805
PRR Bridge <sup>3)</sup>	447.4 <sup>5)</sup>	Gross	5,309	122	2,178	52,270
	447.4 <sup>5)</sup>	Net	4,936	118	2,163	32,504

- Net calculated by assuming the lake-quality water contains 0.834 lb NH<sub>3</sub>-N, 0.008 lb phenol, 0.033 lb cyanide, and 41.7 lb suspended solids per million gallons.
- Data represents the period, July 1974 through June 1976.
- Data represents the period, January 1975 through April 1976.
- NH<sub>3</sub>-N, phenol and cyanide based on Combinatorics data.
- Calculated.

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Table V

Project: Composition of Gary Blast-Furnace Gas-Scrubbers Wastewater  
(Based on a blowdown of 4.0 million gallons per day)

<u>Component</u>	<u>mg/l</u>	<u>lb/day</u>
Ammonia-nitrogen	97	3,222*
Cyanide-Total	6.2	208
Cyanide A**	4.2	140
Thiocyanate	30	1,000
Sulfide	3.1	104
Sulfite	1.6	52
Thiosulfate	6.2	208
Iron (ferrous)	3.1	104
Phenol	4.8	160
Chloride	678	22,618
Sulfate	302	10,075
Fluoride	16	534
Suspended Solids	50	1,042

\* Long-term average ammonia load; daily average (L-4) is 4320 pounds per day which is equivalent to 129 mg/l of ammonia nitrogen.

\*\* Cyanide amenable to chlorination.



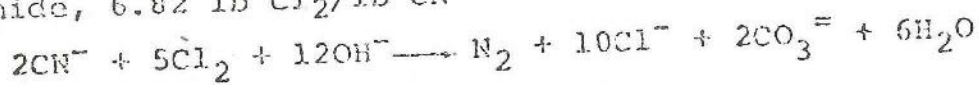
Table VI

Equations for Chlorine Consumption in the Alkaline Chlorination of Various Wastewater Components

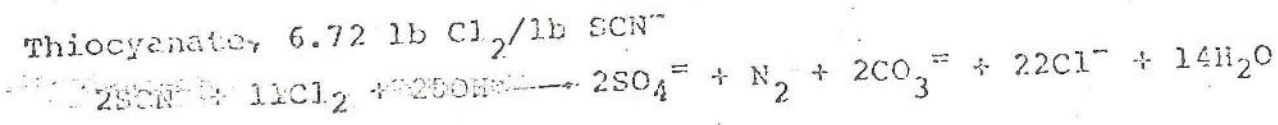
Ammonia-nitrogen, 7.60 lb Cl<sub>2</sub>/lb NH<sub>3</sub>-N



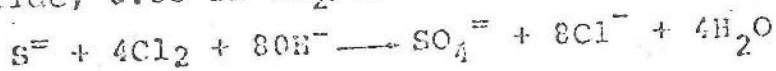
Cyanide, 6.82 lb Cl<sub>2</sub>/lb CN<sup>-</sup>



Thiocyanate, 6.72 lb Cl<sub>2</sub>/lb SCN<sup>-</sup>



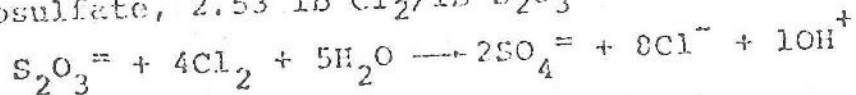
Sulfide, 8.83 lb Cl<sub>2</sub>/lb S<sup>=</sup>



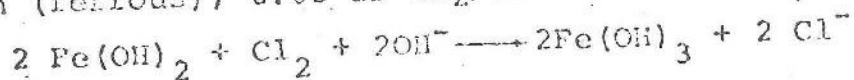
Sulfite, 0.89 lb Cl<sub>2</sub>/lb SO<sub>3</sub><sup>=</sup>



Thiosulfate, 2.53 lb Cl<sub>2</sub>/lb S<sub>2</sub>O<sub>3</sub><sup>=</sup>



Iron (ferrous), 0.63 lb Cl<sub>2</sub>/lb Fe<sup>++</sup>



Phenol, 2.26 lb Cl<sub>2</sub>/lb phenol

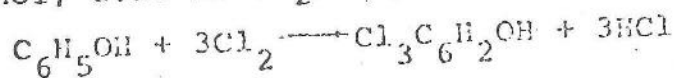


Table VII

Projected Discharge at Gary Works Blast-Furnace Outfall (GW-5)  
With Recycle, and with Alkaline-Chlorination of Blowdown  
 (4.0 mgd flow)

Parameter	Mean		Daily Average		Daily Maximum	
	lb/day	mg/l	lb/day	mg/l	lb/day	mg/l
Ammonia-Nitrogen						
Gross	67	2.0	87	2.6	127	3.8
Net	64	1.9	83	2.5	122	3.7
Phenol						
Gross	1.8	0.05	2.7	0.08	4.2	0.12
Net	1.8	0.05	2.7	0.08	4.2	0.12
Cyanide						
Gross	42.6	1.3	60.2	1.8	89.7	2.7
Net	42.5	1.3	60.1	1.8	89.5	2.7
Sulfate						
Gross	12,455	373	23,339	699	34,797	1,043
Net	11,587	347	21,660	650	32,328	969
Chloride						
Gross	58,168	1,744	92,222	2,764	135,128	4,051
Net	57,801	1,733	91,904	2,755	134,098	4,020
Fluoride						
Gross	34	16	1,068	32	1,602	48
Net	529	16	1,058	32	1,587	48
Suspended Solids						
Gross	334	10	668	20	1,002	30
Net	167	5	334	10	501	15

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Table VIII

Projected Discharge Data for Gary Works—Grand Calumet River Outfalls

(BF recycle with alkaline-chlorination blowdown treatment; treatment facilities for ST-17, one-half of ammonia, phenol, and cyanide above lake-quality water removed in coke-plant discharges.)

Discharge (Outfall No.)	Flow, mgd	Gross or Net <sup>1)</sup>	NH <sub>3</sub> -N, Mean, lb/day	Phenol, Mean, lb/day	Cyanide, Mean, lb/day	Sulfate, Mean, lb/day <sup>2)</sup>	Chloride, Mean, lb/day <sup>2)</sup>	Fluoride, Mean, lb/day <sup>2)</sup>	Suspended Solids Mean, lb/day
Coke Plant (1,2,3,4) <sup>3)</sup>	80.3	Gross	391	6.3	11.8	18,323	8,155	137	8,714
	80.8	Net	314	5.7	9.1	802	742	29	5,244
BF Process Water (5)	4.0	Gross	67	1.8	42.6	12,455	53,168	532	334
	4.0	Net	64	1.8	42.5	11,597	57,801	529	167
BF Nonprocess Water (6,7) <sup>4)</sup>	107.3	Gross	153	2.2	9.1	25,313	13,237	207	10,565
	107.3	Net	64	1.3	5.6	1,721	3,256	62	5,189
Steel Production, Bar and Structural Mills (7A, 8, 10A, 11A, 13, 14) <sup>5)</sup>	257.7	Gross	215	2.1	8.5	69,147	28,828	1,182	28,848
	257.7	Net	0	0	0	13,267	5,187	838	19,049
Sheet and Tin (17)	32.5	Gross	50	4.5	2.5	45,807	21,955	1,206	3,181
	32.5	Net	23	4.2	1.4	38,760	18,973	1,163	1,826
Total of Discharges	482.3	Gross	808	17.1	69	171,045	130,343	3,266	51,642
	482.3	Net	406	13.2	53	66,137	85,959	2,621	31,475
Calc. PRR Bridge	482.3	Gross	1703	8.8	44	171,045	130,343	3,266	47,488
	482.3	Net	1301	4.9	28	66,137	85,959	2,621	27,062

1. Net calculated by assuming that lake-quality water contains 0.834 lb NH<sub>3</sub>-N, 0.008 lb phenol, 0.033 lb cyanide, 217 lb sulfate, 91.7 lb chloride, 1.33 lb fluoride, and 41.7 lb suspended solids per million gallons.

2. Based on a paucity of data for period 1971 through 1974, excluding GW-5.

3. Includes 30 mgd lake-quality water for projected future coke production.

4. Includes 57.0 mgd cooling water (lake-quality water) previously discharged through GW-5.

5. Assumed lake-quality water for all discharges for ammonia, phenol, and cyanide.

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## 1.0 INTRODUCTION

This proposal is in response to a request from United States Steel Corporation, Pittsburgh, Pennsylvania. The assumptions and recommendations contained herein as regards to sampling and measurement locations, techniques and data analysis have been developed on the basis of discussions with United States Steel environmental personnel and subsequent site visits by NALCO Environmental Sciences personnel on April 13 and August 4, 1976.

It is understood that additional data and/or information pertinent to the site, but unknown or unavailable at the time this document was prepared may necessitate modifications to assure the proposed efforts result in a technically valid and economically feasible investigation. These modifications, if any, will be incorporated, as mutually agreed by NALCO E.S. and United States Steel, prior to the initiation of the program.

It is NALCO E.S. intent to render the necessary services and labor, as required, to accomplish the objectives of this investigation as stated in Section 2.0 of this proposal. We propose to conduct the program in as expeditious manner as possible, compatible with our demands for accuracy and reliability.

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## 2.0 OBJECTIVES

The objectives of the investigative program as described in detail in Section 4.0, Scope, of this proposal are:

- 2.1 To determine point source origin(s) of any or all of the following specified contaminants; Total Suspended Solids, Phenol, Ammonia, Total Cyanide, and Oil and Grease detected to be present in each of the three (3) Coke Plant waste discharges, GW-1, GW-2 and GW-3, to the Grand Calumet River.
- 2.2 To determine point source origin(s) of any or all of the following specified contaminants; Total Suspended Solids, Phenol, Ammonia, Total Cyanide, and Oil and Grease detected to be present in the Sinter Plant No. 3 waste discharge, GW-4, to the Grand Calumet River.
- 2.3 To determine the total flow volume of each of the individual waste discharges in 2.1 and 2.2 above, GW-1, GW-2, GW-3 and GW-4, respectively.
- 2.4 To determine the proportionate flow volumes contributed by each of the major laterals entering each individual waste discharge.
- 2.5 To establish total contaminant discharge loadings for each individual specified contaminant listed in 2.1 and 2.2 above. Contaminant discharge loadings will be determined from the data obtained via flow measurements and sample analyses.

12625

**Brown & Root, Inc.**

Chicago Engineering Division, Commerce Plaza North Bldg.  
2001 Spring Road, Oak Brook, Illinois 60521

Horace S. Hunt, Jr.  
Vice President

(312) 887-4111

August 2, 1976



Mr. J. G. Dickinson  
Manager - Design Engineering  
United States Steel Corporation  
600 Grant Street, Room 810  
Pittsburgh, Pennsylvania 15230

Attention: Mr. O. M. Maide

Subject: Proposal for Engineering Services BD-90  
Gary Works Water Quality Control Project  
United States Steel Corporation

Gentlemen:

In response to your letter dated July 29, 1976, Brown & Root, Inc. is pleased to present this proposal to provide engineering services for the development of your Water Quality Control Project in the Blast Furnace Area at Gary Works, Indiana.

I. SCOPE OF WORK

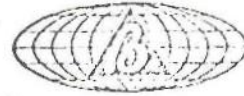
A. Phase I

Brown & Root, Inc. will perform "pre-authorization" engineering and design work to develop an estimated total installed cost for the blast furnace water recycle system as shown on your flow diagrams and plans numbered:

L-6025-3-2	-	5-10-76
L-6025-3-3	-	5-14-76
L-6025-3-4	-	5-18-76
L-6025-3-5	-	5-21-76
L-6025-3-6	-	6-21-76
L-6025-3-7	-	6-24-76
L-6025-3-8	-	6-28-76
L-6025-3-9	-	6-24-76
L-6025-3-10	-	6-14-76
L-6025-3-11	-	6-18-76

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United States Steel Corporation  
Gary Works Water Quality Control Project  
Proposal BD-90  
August 2, 1976  
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This work will include design calculations, preparation of process control diagrams, piping and instrumentation diagrams, block and flow diagrams, mechanical flow sheets, electrical single lines and the necessary general arrangements, plans and sections required to obtain material quantities for estimating purposes. Work will also include preparation of specifications for major items of equipment to obtain pricing information and an estimate of utility requirements.

B. Phase II

Brown & Root will furnish "post-authorization" engineering and design work required to prepare construction drawings, remaining equipment specifications, bills of material, construction/installation specifications, vendor approvals, preparation of operating and maintenance manuals and as-built drawings.

II. PLAN OF WORK

A. Schedule

1. Phase I

To perform the "pre-authorization" engineering as outlined in the scope of work will require approximately 10 weeks to complete from the date we are authorized to proceed.

2. Phase II

Based on information from equipment suppliers, we estimate the post-authorization engineering will require approximately 7 months to complete. During Phase I of the project, a definite schedule for Phase II will be developed and will be correlated with construction schedules.

B. Performance

Upon acceptance of this proposal, the project manager and lead personnel from each discipline will meet with United States Steel Corporation personnel to review scope of work and exchange information necessary to commence working on the project.

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United States Steel Corporation  
Gary Works Water Quality Control Project  
Proposal BD-90  
August 2, 1976  
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A definitive schedule of work will be developed that is acceptable to both United States Steel and Brown & Root. Administrative procedures that are to be followed throughout the course of the project will be established. A site visit to Gary Works must be made by key personnel as soon as possible. To expedite the project, we suggest that Brown & Root be allowed to obtain reference material direct from Gary Works.

Having completed the necessary design calculations, field investigations, layouts, flow sheets and schematics, a funding estimate will be prepared in sufficient detail for corporate use in pricing, obtaining funds, permits, and approvals of schedules for execution of the project.

The project manager for Brown & Root, Inc. will have complete responsibility for the project and all correspondence will be directed to his attention.

We estimate Phase I of this project will require 4760 manhours of engineering, drafting and support time at an estimated cost of including non-labor expense. At this time, we do not anticipate working overtime manhours on the project. However, should an emergency arise where overtime would be required, with prior approval from USS, it would be billed in accordance with procedures outlined in our commercial terms.

An estimate of manhours and costs for Phase II of this project will be submitted when sufficient information has been developed during Phase I to present realistic values.

#### C. Additional Details

Phase I of the project will require an estimated 40 drawings and approximately 4 specifications.

We estimate it will require 12 to 15 trips between our Oak Brook Engineering Office and Gary Works during the course of Phase I, at an estimated cost of non-labor charges per round trip. However, actual cost will be in accordance with the attached Automobile and Other Transportation Services - Pricing Schedule.

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United States Steel Corporation  
Gary Works Water Quality Control Project  
Proposal DD-90  
August 2, 1976  
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Reproduction cost will be in accordance with the attached  
Reproduction Services - Pricing Schedule.

All work outlined in this proposal will be performed in the Brown & Root, Inc.  
Chicago Engineering Division office located in Oak Brook, Illinois.

United States Steel Corporation should designate representatives responsible  
for liaison and approval of work elements as they are developed. Office  
space will be provided in our Oak Brook facility for your representative  
if desired.

For reporting and billing purposes, Brown & Root, Inc. has a standard account-  
ing system based on weekly reporting of hours. Therefore, monthly invoices  
will actually be submitted for either a 4 or 5 week month, and the month will  
end on the last Saturday of a calendar month.

### VII. COMMERCIAL TERMS

Our actual fee for the work outlined in this proposal will be computed  
in accordance with the attached Brown & Root, Inc. "Standard Terms  
and Conditions for Engineering and Technical Services", Revision  
dated March 28, 1976.

Our proposal for furnishing these services can be considered firm  
until October 1, 1976.

Personal secretaries' and clerks' time will not be billed, however,  
time expended by MFS operator or typist to produce specifications  
will be billed.

Item B-2 in our "Terms and Conditions" applies to purchasing or  
projects of a major scope.

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# R. T. PATTERSON COMPANY, INC.

Engineers and Consultants

-4-

The above cost estimate of drawings and manhours is our best judgement based on limited information given to us by United States Steel Corporation. We were advised that within 30 days more definitive information will be made available to us which will permit us to prepare a better estimate of manhours. We shall submit a re-estimate of the above work within 15 days following the receipt of this information.

Based on above estimate of manhours and Schedule of Compensation, we estimate the cost of Pre-authorization Engineering as  
to United States Steel Corporation  
as per summary below.

10,000 Engineering manhours

Estimated cost of travel, telephone  
and printing

## TOTAL ESTIMATED COST

Our above estimate of manhours and costs is further based on following assumptions and exclusions.

1. Our Scope of Work will start from the inlet of the existing scalpers and end in the cooling tower complex. The cold wall pump sizing and piping distribution to the blast furnaces will be by others. All electric and operating controls of the cold wall pumps is included in our proposal. We shall coordinate our work with others as to the location of these pumps in the cooling tower complex.
2. For purposes of Pre-authorization work no layouts, general arrangements or estimating data sheets are included for any architectural work related to relocation of wash and locker rooms and maintenance shop. We have also excluded from the above facilities all heating and ventilating, utility requirements, underground sewer facilities from our proposal and it is our understanding that United States Steel Corporation will furnish this data for Pre-authorization requirements.
3. We visualize the following items of equipment for which we will prepare purchase specifications and evaluate the bids. These specifications will follow the format of United States Steel Corporation's specifications.

Scalper Sludge Pumps  
Hydrocyclone  
Screw Classifiers  
Thickener

12634



Industrial Waste Water Facilities designed by R. T. Patterson Company,  
Inc. in the last five years.

Jones & Laughlin Steel Corporation

1. Detail construction engineering and cost estimates for Corporate appropriations for water recycle system (10,000 G.P.M.) for blast furnaces of the Corporation at Cleveland, Ohio.

System involved installation of collecting system, pump houses, cooling tower complex complete with hot and cold well pump houses, chemical treatment for water quality control, vacuum filters, and water distribution piping with controls from cold well to the blast furnaces.

2. Design and construction engineering for complete water recycle system (20,000 G.P.M.) for 80" H.S.M. at Cleveland Works including pump houses, cooling tower complexes and distribution system with controls.

3. Complete design and construction engineering for water cycle system (16,000 G.P.M.) for slabbing mill at Cleveland, Ohio including modifications of scale pits, pump house, flume flushing, scum float distribution and return system to the clarifiers.

4. Design and construction engineering for installation of monitoring systems on the blast furnaces and hot strip mill outfalls at Cleveland, Ohio.

5. Design and construction engineering for Phase I waste water recycle system including two river pump houses and water treatment plant at Aliquippa Works. This system basically involved intercepting and collecting all outfall sewers discharging into Ohio River and pumping it to the above treatment facilities.

6. Design and construction engineering for Polymer Injection into the new pressure mains installed under item 5 above for improved clarifier performance.

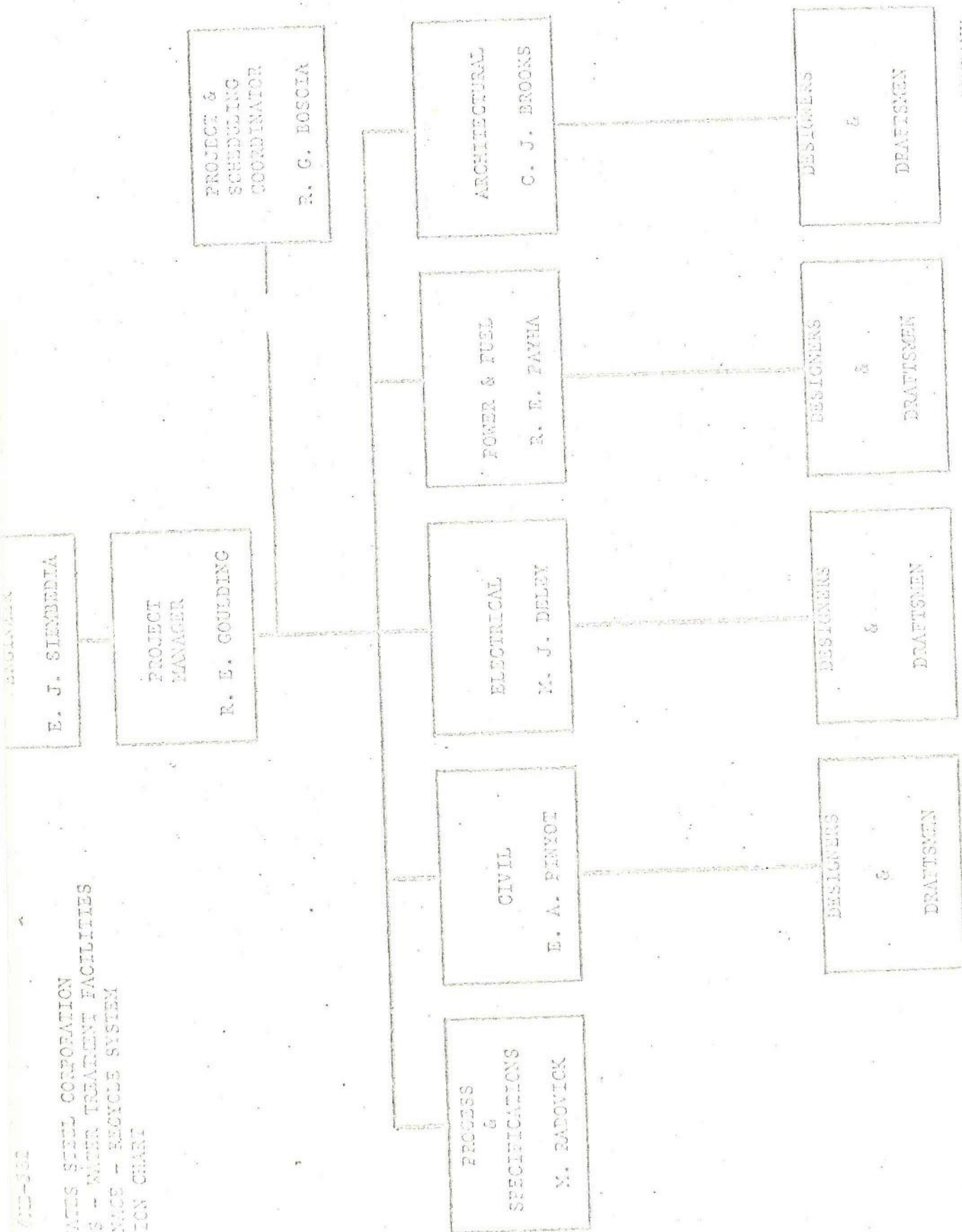
7. Design and construction engineering for modification of distribution system to the thickeners and addition of acid systems to improve water quality from two thickeners in the blast furnaces water system at Aliquippa Works.

8. Possibility Study for improved scale pit performance of the following at Aliquippa Works.

Hot strip mill main scale pit.  
Bar and billet mill scale pit.  
44" blooming mill scale pit.  
Welded tube mill scale pit.

12637

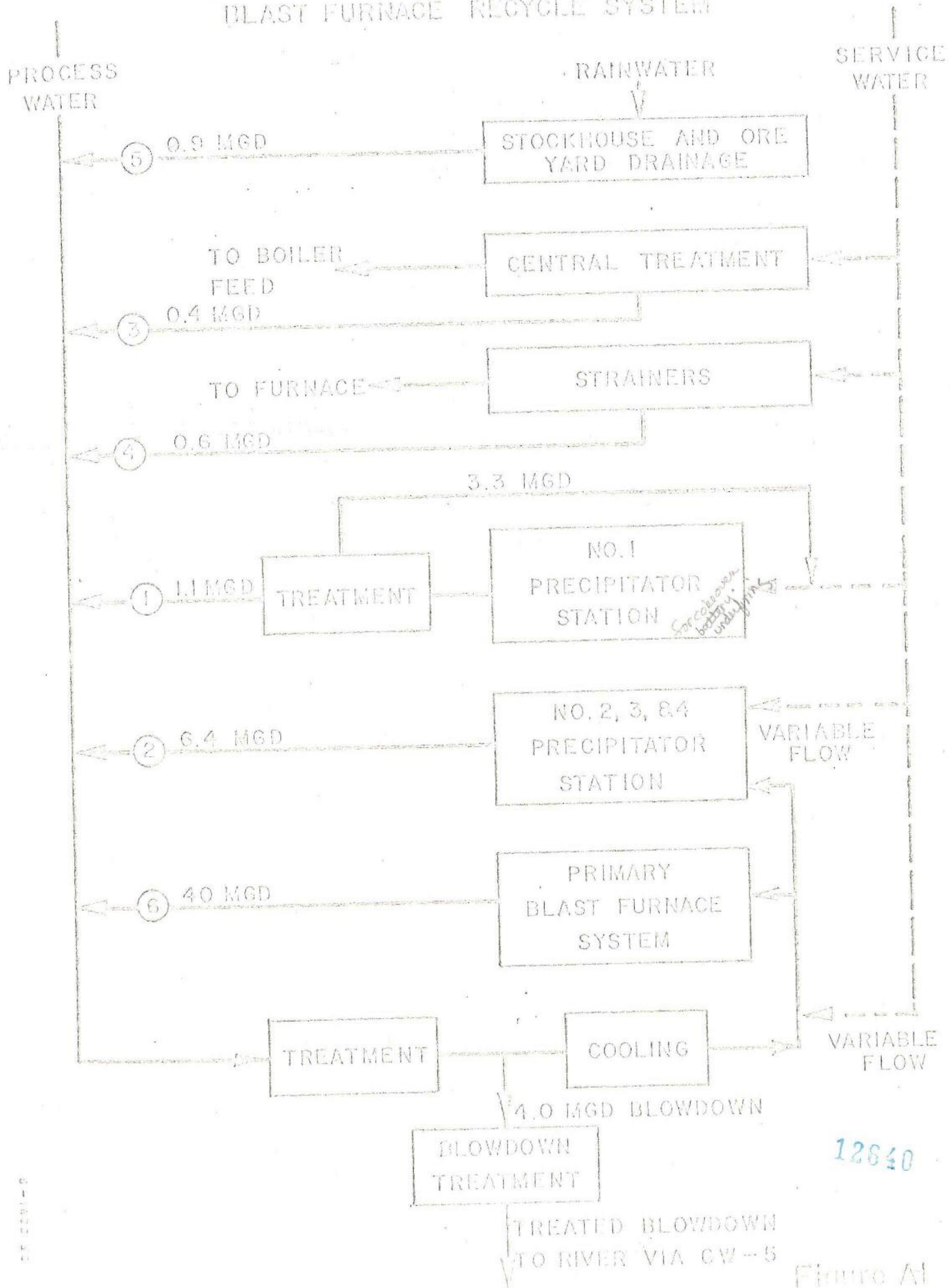
UNITED STATES STEEL CORPORATION  
 CANNON - WALKER TREATMENT FACILITIES  
 EAST PITTSBURGH - RECYCLE SYSTEM  
 ORGANIZATION CHART



R. T. PATTERSON COMPANY, INC.  
 ENGINEERS & CONSULTANTS  
 AUGUST, 1976



# FLOW SCHEMATIC FOR GARY WORKS BLAST FURNACE RECYCLE SYSTEM



12840

ENGINEERING AND CONSTRUCTION SCHEDULE  
BLAST FURNACE PROCESS WATER RECYCLE SYSTEM  
CARRY WORKS  
CRITICAL ANALYSIS OF CONSTRUCTION ITEMS

The project to recycle the blast furnace process waters essentially comprehends diverting the CW-5 discharge to a cooling tower and returning the cooled water to process use on the furnaces. Non-contact furnace cooling water, a substantial portion of which is presently reused for gas cooling and washing, will be separated and discharged directly to CW-6. This change will require replacement of all of the clean water sewer laterals from the furnaces to the main CW-6 clean water sewer.

While the entire project will be difficult to accomplish due to the age of the facilities and the congestion in the areas to be affected four parts are given special attention. These are taken from the total scope and listed for this purpose in order of complexity. They are as follows:

Item 5

Install approximately 4800 feet of large diameter pipeline from the cold well pumps to the vicinity of No. 11 and No. 12 furnaces as the main return water line. The scope comprehends running this pipe underground east of the blast furnaces.

Item 6

Install connections between the large diameter pipeline and the furnaces that will be operating. This will require approximately 200 feet of 12" diameter pipe at each furnace in addition to numerous connections, fittings, etc.

Item 2

Replace existing clean water sewer on each furnace by installation of a new lateral (approximately 200 feet of 36" sewer at each furnace) to provide adequate capacity to convey the increased volume of cooling water to CW-6.

Item 4

In the area of the present scalper-clarifier-settling basin complex, the major equipment to be installed will be a hot well pump station, a multi-coil cooling tower, a cold well pump station, and substation facilities, as well as a sludge thickener, vacuum filter sludge dewatering facilities, various buildings to house each of this equipment, and incoming power and utilities.

Discussion

The large diameter pipeline (Item 5) would be installed between 12 blast furnaces and their serving stockhouse. It is proposed to lay the pipe underground, between an existing process water sewer, two water lines, a railroad track, and the stockhouse, all of which must be maintained in operation. For much of the run there is only 15 feet of overhead clearance between the railroad track and the stockhouse. In addition, there are ship ladders, hoist houses, maintenance buildings, dust catchers, and numerous other obstacles at each furnace for the entire route on the furnace row. Also, the entire length is paved and building and dust catcher foundations jut into the pipeline route. To surmount these



obstacles will require extensive concrete removal and replacement and numerous changes in pipe direction.

The connections under Item 6 will take off from the main header and will require extensive work in the same limited area.

The location of the work is such that in order to maintain access to the operating furnaces, a single pipe laying crew would be forced to work in one direction only since the pipe route is the only way in or out of the area between the blast furnaces and the stockhouse for a distance of approximately 2400 feet.

It is imperative that this access be maintained to this area at all times for reasons of safety and in the event of an emergency. Further, it is the haulage route for the removal of dry fine dust and re-screened coke which are normal dry by-products of the blast furnace operation. In addition, it is the access for maintenance, operating supplies and equipment, etc.

When furnace rebuilds occur, there will be periods during pipeline installation which will require the use of the entire area between the stockhouse and the furnace and will require intensive coordination to assure that both jobs proceed on schedule.

The sewer laterals in Item 2 must be installed under six hot metal and hot slag tracks which must be maintained in operation at each furnace. Considering the constant rail movement in this extremely hazardous area, the installation of the laterals will require extraordinary coordination between operating and construction. There is no road access between the blast furnace and the tracks.

All of the facilities under Item 4 in the area of the scalper-clarifiers-settling basins will have to be installed in the limited and congested areas and all of the work will have to be done without taking the present treatment facilities out of service.

In addition to all of the aforementioned interferences, it should be pointed out that there will be a minimum of three construction winters on the shore of Lake Michigan, which historically are severe for construction purposes.

Approximately 60-70% of the appraised cost of this project is attributable to field construction, and, therefore, most of the work is in the area where circumstances and obstacles could most influence progress.

The milestone schedule depicts the most optimistic schedule possible considering the aforementioned scope of work and the attendant difficulties. It is based upon optimum manpower, and anticipated deliveries of these types of equipment and materials which we have been experiencing in recent times on other projects. Also, it is based on preliminary appraisals only and not upon an engineered project.

In addition this schedule contains absolutely no contingency for any unknown circumstances beyond our control such as: strikes, extreme weather, fires, failure of vendor deliveries, unknown site interferences, and all other acts over which U. S. Steel cannot exercise control.

It should be pointed out that the time after preliminary engineering is totally dependent upon receipt of permits required by the various agencies. The period after construction has been completed and testing initiated, to the attainment of operation levels, has been stated as three (3) months. This reflects an overlap of one (1) month testing during final construction. Realistically, this period could be extended beyond this time schedule, dependent upon performance of the facilities as defined.

#### Milestone Schedule

Installation of the proposed waste water recycle system will require an estimated thirty-seven (37) months with the following identifiable milestone dates.

Months After  
Acceptance of  
Proposal

- I. Complete preliminary engineering sufficient to file waste water treatment permit application.

3 months

During this initial period, it will be necessary to complete extensive field investigations at the blast furnaces to determine specific location and flows of effluent from the furnace facilities and to finalize locations for such recycle system components as the routing of 4,800 feet of large diameter recycle water distribution main piping plus the necessary pumping, cooling tower and control facilities and related foundations and utility connections.

During these initial field investigations, project layout drawings and process designs will be prepared. From these documents, equipment specifications are developed and issued.

These same drawings and specifications, as a minimum will be required to complete an application for the required waste water treatment permit and to initiate project financing arrangements.

- II. Receive installation permit and project financing approvals.

5 months

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Months After  
Acceptance of  
Proposal

III. Complete placement of major equipment orders.

7 months

Contract placement activity, would be initiated immediately following permit and financing approvals (Milestone II) for such major items as cooling towers, pumps, valves, vacuum filters and electrical gear.

IV. Initiate Field Construction

11 months

Based on current experience, it is estimated that equipment deliveries will have progressed by this time to a stage where field construction can be initiated. During the intervening time following completion of preliminary engineering (Milestone I), it will also be necessary to complete all detailed construction drawings, complete and issue all installation specifications, obtain bids on same and place construction contracts.

V. Complete Construction

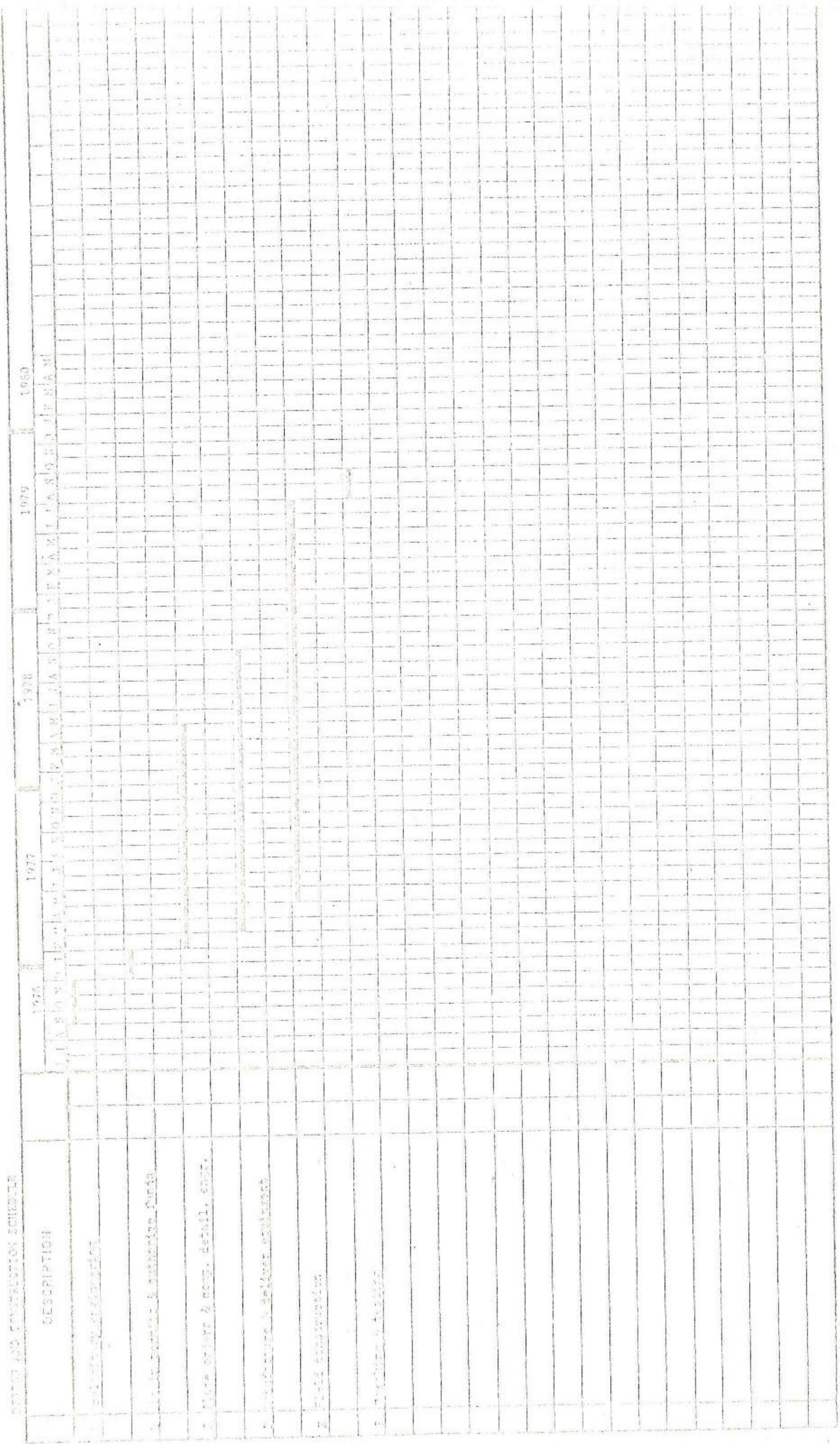
35 months

Complete construction of the central recycle facilities including connection to operating blast furnaces and initiate check-out of the system.

VI. Complete final check-out and attain operational level on all operating furnaces.

37 months

UNITED STATES DEPARTMENT OF COMMERCE  
BUREAU OF ECONOMIC ANALYSIS





Attachment 5

DETAIL EXPLANATION OF  
DESIGN AND CONSTRUCTION SCHEDULES

A. PRELIMINARY ENGINEERING

A description of the work involved under the heading preliminary engineering comprehends the following:

1. Review broad project scope, effluent quality requirements, and process philosophy.
2. Establish procedures and responsibilities within the Engineering Department.
3. Identify applicable codes, special conditions, standards and plant production and operating conditions.
4. Develop a detailed engineering and construction schedule.
5. Prepare final block flow diagrams, mechanical flow sheet, process control diagram, layout of the above and below ground interferences, conduct soil surveys, make plot plans, general arrangement, and preliminary piping and instrumentation drawings.
6. Concurrently, with the drawing work in Number 5 above, prepare specifications for the purchase of equipment, issue same for bidding, obtain and evaluate bids.
7. Prepare and submit for funding an accurate cost estimate for the total project. The estimate is based on equipment bids, material take-offs, estimates of field construction cost and final engineering requirements.
8. Prepare and submit final paper permit application.

B. OBTAIN PERMITS AND AUTHORIZE FUNDS

Funding arrangements will be completed concurrent with the processing of the permits. Both the permits and funding activities require prior completion of preliminary engineering in order to establish facility specifics and cost. Permit and funding activities should be completed prior to order placement.

C. PLACE ORDERS AND COMPLETE DETAILED ENGINEERING

A description of the work involved under the heading Place Orders and Complete Detailed Engineering comprehends the following:

1. Quotations reviewed during the preliminary engineering phase must be updated and finalized for placement.

C. PLACE ORDERS AND COMPLETE DETAILED ENGINEERING (Continued)

2. Place an order to include final design engineering.
3. Additional specifications and requisitions not developed during the preliminary engineering phase must be developed, issued for bid, processed and purchase orders must be placed.
4. Review and approve vendors engineering drawings.
5. Perform construction field surveys and sub-soil investigations.
6. Prepare construction drawings for foundations, structural, electrical, piping, insulation, buildings, and instrumentation erection contracts.
7. Prepare and issue for bidding, field construction specifications, receive proposals, evaluate and prepare tabulations for placement.
8. Obtain necessary related permits.

D. MANUFACTURE AND DELIVER EQUIPMENT

Upon receipt of a purchase order from United States Steel, the equipment supplier must perform the following work:

1. Reserve shop space and time for future fabrication of his equipment.
2. Prepare detailed drawings and obtain United States Steel approval.
3. Enter orders with subcontractors for material, parts, etc., required for his equipment.
4. Expedite his subcontractors.
5. Fabricate, assemble, code, and test his equipment.
6. Paint the equipment and arrange for loading, shipment and delivery.
7. Prepare and submit installation, operation, and maintenance materials.

While the equipment supplier is performing the above work, United States Steel is expediting the supplier, with emphasis on critical items, to insure that required delivery dates are met. Expediting begins with the placement of the order and the initial contact with the supplier to confirm

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D. MANUFACTURE AND DELIVER EQUIPMENT (Continued)

that the required delivery date will be met. Additional checks are made thereafter as deemed necessary. If a serious problem with the equipment suppliers' subcontractors is identified, United States Steel would offer to assist in obtaining material or offer other assistance to improve the delivery. If a problem develops with the equipment supplier, an inspection trip would be taken to identify the true problem, establish corrective measures to be taken, and advise involved personnel of any changes in delivery date.

E. FIELD CONSTRUCTION

The start of field construction precedes the completion of final engineering and the receipt of major equipment. The field construction phase of a project involves the following:

1. Site clearance. This is the preparation of the construction site. It includes removing and relocating existing equipment, buildings, piping or sewers in order to obtain a usable site for the new facility.
2. Foundations. As "approved for construction" drawings are received, the foundation contractor will lay out each foundation. This includes protecting existing facilities, driving sheet and bearing piling, excavating, approving shop drawings, ordering, and accepting delivery of anchor bolts, imbedded steel and reinforcing steel bars, fabricating and erecting forms, installing reinforcing bars, anchor bolts and imbedded steel, roughing in sewers, installing conduit and piping to be imbedded in concrete and then pouring, finishing and curing concrete and back-filling foundations as required.
3. Structural. The fabricated structural steel is shipped by truck and rail to the job site. It must be unloaded, segregated and stored. Each piece must be checked against bills of material and match marked. Columns are erected, interconnecting steel is bolted up, levelled and aligned. Finish coats of paint are applied and corrugated sheeting is installed on building walls and roofs.
4. Mechanical, piping, electrical and instrumentation installation. Mechanical equipment upon arrival must be unloaded, inspected and placed in storage, transported to installation sites, unloaded again, set, levelled, aligned, shimmed and grouted. Equipment is delivered partially assembled for shipping purposes and requires field assembly including welding. Piping must be installed to

E. FIELD CONSTRUCTION (Continued)

4. (Continued)

connect existing utilities to new equipment. Piping is both shop fabricated and field fabricated and installed both underground and overhead. Invariably many unanticipated field interferences are encountered which cause extensive rerouting of pipe and re-fabrication work. New electrical requirements necessitate additions to existing substations or even new substations. Electrical switch gear and motor control center are installed and wiring is extended to new equipment. Installation of instrumentation and automatic controls is done after sufficient electrical and piping work have been completed. Insulation work and field painting are performed as the work progresses in all areas where operations permit.

In general, the field construction activities are sequenced as described above. These activities cannot be started simultaneously but each must be phased-in after a portion of the preceding activity is completed.

F. CHECKING AND TESTING

This portion of the schedule includes continuity tests on electrical and instrumentation systems, operation of pumps and drivers to determine flow and head characteristics, operation of major pieces of equipment to determine compliance with specifications and calibration of valves and instrumentation. At this time, the waste stream will be introduced into the system and preliminary tests conducted on each major piece of equipment. Finally, the system will be brought up to design flows to reach equilibrium conditions and the reliability and compliance with specified effluent conditions determined.

PROPOSAL FOR

WATER QUALITY CONTROL PROJECTS  
ELECTROLYTIC TITRATING LINES  
WEST MILLS PICKLING FACILITIES  
AT GARY WORKS

FOR

UNITED STATES STEEL CORPORATION  
PITTSBURGH, PENNSYLVANIA

SUBMITTED BY

BOYNTON ENGINEERS  
549 WEST RANDOLPH STREET  
CHICAGO, ILLINOIS 60606

AUGUST 20, 1976  
(BE-7605)

12650



# BOYNTON ENGINEERS

CONSULTING ENGINEERS  
DESIGNERS

549 WEST RANDOLPH STREET, CHICAGO, ILL. 60606, TELEPHONE 236-8442 AREA CODE 312



JOHN A. ROONEY, JR.

August 20, 1976

Mr. J. C. Dickinson  
Manager Design  
United States Steel Corporation  
600 Grant Street  
Pittsburgh, Pennsylvania 15230

Attention: Mr. O. M. Maide

Project Coordinator

Subject: Proposal for

Water Quality Control Projects

Electrolytic Tinning Lines

West Mills Pickling Facilities

Gary Works

Gentlemen:

As requested by Messrs. G. E. Cason and W. C. Willard in our meeting in Pittsburgh on August 11, 1976, Boynton Engineers, Division of Lester B. Knight & Associates, Inc., herein after referred to as Boynton, is pleased to submit this proposal to furnish pre-audithorization and post-audithorization engineering services for the Water Quality Control Projects at the Electrolytic Tinning Lines and West Mills Pickling Facilities at the Gary Works of United States Steel Corporation.

Electrolytic Tinning Lines Project

The Gary Works has four electrolytic lines, three of which are tinning lines and one is a tin-free line. On each line there are two problem areas:

1. Leak and Overflow Collection System: The plating and dragout baths on the tinning lines currently leak electrolyte to a general waste water collection system under the lines. The electrolyte is preventing a contamination problem in the collection system. In the case of the tin-free line, in addition to plating bath leaks, the dragout bath overflows to the collection system. Boynton is to design a system to selectively collect only the electrolyte leaks and overflows from plating and dragout baths and return them to the electrolytic recirculating system after filtering.

12851

2. Heat Exchanger, Evaporator, Condenser Circuit for Electrolyte Recirculation System on the Three Tinning Lines: Currently the evaporators have centrifugal type entrainment separators which are not doing an adequate job of collecting phenolsulfonic acid and tin. They are to be replaced by more efficient mesh type mist eliminators. In addition, contaminated steam from the evaporator is condensed in an eductor condenser. Some of the condensate is returned to the recirculation system by way of the dragout rinse tank, and the overflow goes to a collection system. The problem is that contaminated condensate in the form of phenol is entering the collection system. Boynton is to redesign the condenser circuit to separate phenols and steam and to return the contaminants to the recirculation tank by way of the dragout rinse tank, and direct steam condensate to the collection system.

Process design for both of these systems will be by U. S. Steel and the tinning lines are shown on a preliminary flow balance sheet titled "Contaminated Water Treatment Facilities, Electrolytic Tinning Lines, Gary Works, Waste Water Treatment Item No. V". It is assumed that the design will be an adaptation of a similar project which was successfully installed at the Irvin Works. Boynton has received a copy of the Irvin Works piping drawings for reference. A similar flow sheet will have to be developed for the tin-free line.

#### Pickling Lines Progress at the West Mills

Steel is pickled at two locations in the West Mills by a batch process. At each location, there is a series of acid, lime dip, and rinse water tanks. Currently, spent acid and rinse water are drained by way of a combination siphon and gravity collector system to a holding pond. Underground seepage from the pond is finding its way to a nearby sewer and contaminating it. U. S. Steel intends to eliminate the requirement of using the pond. Boynton is to redesign the system and separate it into a waste acid system and a rinse water system as follows:

1. Waste Acid System: Waste acid is to be pumped from the north pickle line to the drain collector for the south pickle line. The drain collector for the south pickle line is to be intercepted and directed to a two cell 120,000 gallon holding tank. Waste acid will be pumped from the holding tank to tank trucks for disposal at another location.
2. Rinse Water System: A collection system and sump and pumps will be installed at both lines for collecting rinse water. Rinse water will then be pumped by an overhead piping system to a new manhole with a weir overflow to GW-12 Sewer.

12652



The new system is shown on a marked-up print of drawings C-0358002 and noted as Alternate No. 4.

Boynton personnel have made a field trip on August 16, 1976 with Mr. B. Sutton of Pittsburgh Design and Messrs. C. Watt and R. Hufmann of Gary to inspect the electrolytic timing lines and pickling lines at the West Mills.

Scope of Services to be Furnished by Boynton

Boynton has received and reviewed a copy of the U. S. Steel Engineering Services Memorandum relative to Water Quality Control Projects. The memorandum defines the Scope of Engineering Services for Water Quality Control Projects. The work consists of complete pre-authorization engineering to establish corporate funding and scheduling requirements. Boynton will furnish design and engineering services necessary to complete pre-authorization engineering as outlined in the Engineering Services Memorandum.

We are assuming that electrical and structural drawings and specifications for the Irvin Works will be made available. We are also assuming that adequate power is available in all areas.

The Engineering Services Memorandum also requests a separate proposal to cover post-authorization engineering consisting of construction drawings, remaining equipment specifications, B/M's, construction/installation specifications, vendor approvals, preparation of installation/operation/maintenance manuals and as-built drawings. Boynton has included an estimate to furnish post-authorization engineering services, but this should not be considered firm at this time. The following items require development before a firm proposal on post-authorization engineering services can be provided.

- o A flow sheet for the tin-free line.
- o Drawings of existing facilities.
- o The electrolytic timing flow sheet is preliminary and we are assuming the project will be an adaptation of the Irvin Works Installation. Balances will have to be adjusted to reflect the fact that two lines have twin evaporators and one has a single evaporator, and the tin-free line has no evaporator cycle.
- o The pickling lines also have lime coating tanks. Disposition of this waste must be defined.
- o Soils information.
- o U. S. Steel format, drawings procedures or standard specifications.

12653



Based on our current knowledge of the projects, the Engineering Services Memorandum and similar experience with other steel mill clients, Boynton has developed an estimate of scope of the post-authorization engineering. All of the factors that effect a firm proposal at this time for post-authorization are to be clarified during pre-authorization engineering. At that time, Boynton would re-evaluate the scope of work and resubmit a not-to-exceed proposal for post-authorization engineering services.

#### Qualifications

We have attached a copy of a brochure describing Boynton's qualifications to perform piping and water quality control projects and select the related equipment. This is the same brochure presented in the meeting of August 11, 1976, but updated to include an actual project organization chart and additional resumes.

We were also asked how we would utilize a process consulting service to develop the job from the U. S. Steel furnished process information. For the electrolytic tinning lines, it is understood that U. S. Steel intends to furnish all process information for design. The pickling lines do not seem to involve process development. We therefore do not intend to utilize process consulting services for either of these projects.

Should something develop during the project where water quality expertise is required we would utilize a firm like Betz for professional assistance.

#### Staffing

Based on the assumption that the project will start in the immediate future we have prepared and updated the qualification brochure to include a pre-authorization project organization chart showing the key people that are to be involved. Assuming there is no large delay between pre-authorization and post-authorization services we would continue these same key people into the next phase, supplementing them as required.

The updated qualification brochure also includes, additional resumes for people who appear on the organization chart, but were not included in the original brochure.

#### Project Control

Boynton relies on a strong project management approach with frequent direct participation and monitoring by the Technical Director. The project manager is responsible for the quality, cost and time elements on the project. The attached brochure describes in more detail the tools which are used to aid in the control of a project. We have also enclosed Exhibits I through IX which are samples of forms that we use for scheduling, drawing and cost control, project reporting and conference notes. We have also attached Exhibit X which are flow sheets indicating how internal and external correspondence is processed.

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Time Schedule

We estimate that we can perform the pre-authorization engineering services in a period of four months after receipt of authorization to proceed. This assumes that six weeks will elapse from the time we deliver specifications to U. S. Steel until we receive unpriced copies of bids for technical evaluation.

We have attached Exhibit XI which is a schedule showing completion of the pre-authorization engineering in four months.

We estimate that we can perform the post-authorization engineering services in a period of six months after receipt of authorization to proceed.

We have attached Exhibit XII which is a Boynton Manpower Utilization Forecast broken down by discipline. In the key discipline of mechanical, we are showing an excess of 4 to 5 engineers and draftsmen in the period of September through December with adequate support available from structural and electrical. This should be more than adequate to handle the pre-authorization services. It indicates that we can also handle the post-authorization services without difficulty.

Fee Proposal

For the performance of Pre-authorization Engineering Services, the Boynton Engineers Division of Lester B. Knight & Associates, Inc., is to be compensated at average charging rates shown in Exhibit XIII. It is estimated that the services to be performed will not exceed 3,055 man-hours or . without your prior approval. This breaks down to 2,364 hours or for the electrolytic timing lines and 691 hours or for the West Mill pickling facilities.

We have attached Exhibit XIV, a Drawing List, Exhibit XV, a Specification List and Exhibit XIII, a Fee Breakdown to support this proposal.

Invoices are to be submitted monthly in accordance with actual time spent on your behalf of this project.

Boynton Engineers Division of Lester B. Knight & Associates, Inc., shall render the services in accordance with generally accepted engineering practices and makes no other warranty, either expressed or implied.

You will indemnify and hold us harmless for any claims of others for personal injury or death or loss or damage to property arising out of or

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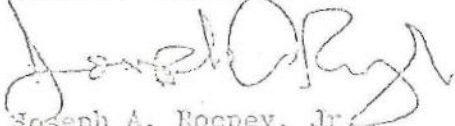
United States Steel Corporation  
August 20, 1976  
Page Six

in connection with the work performed hereunder unless such claim arises from our active negligence.

We look forward to working with you on this most important project and are prepared to start work immediately upon your authorization.

Very truly yours,

BOYNTON ENGINEERS

  
Joseph A. Rooney, Jr.  
Vice President

JAR/bb

(DE-7606)

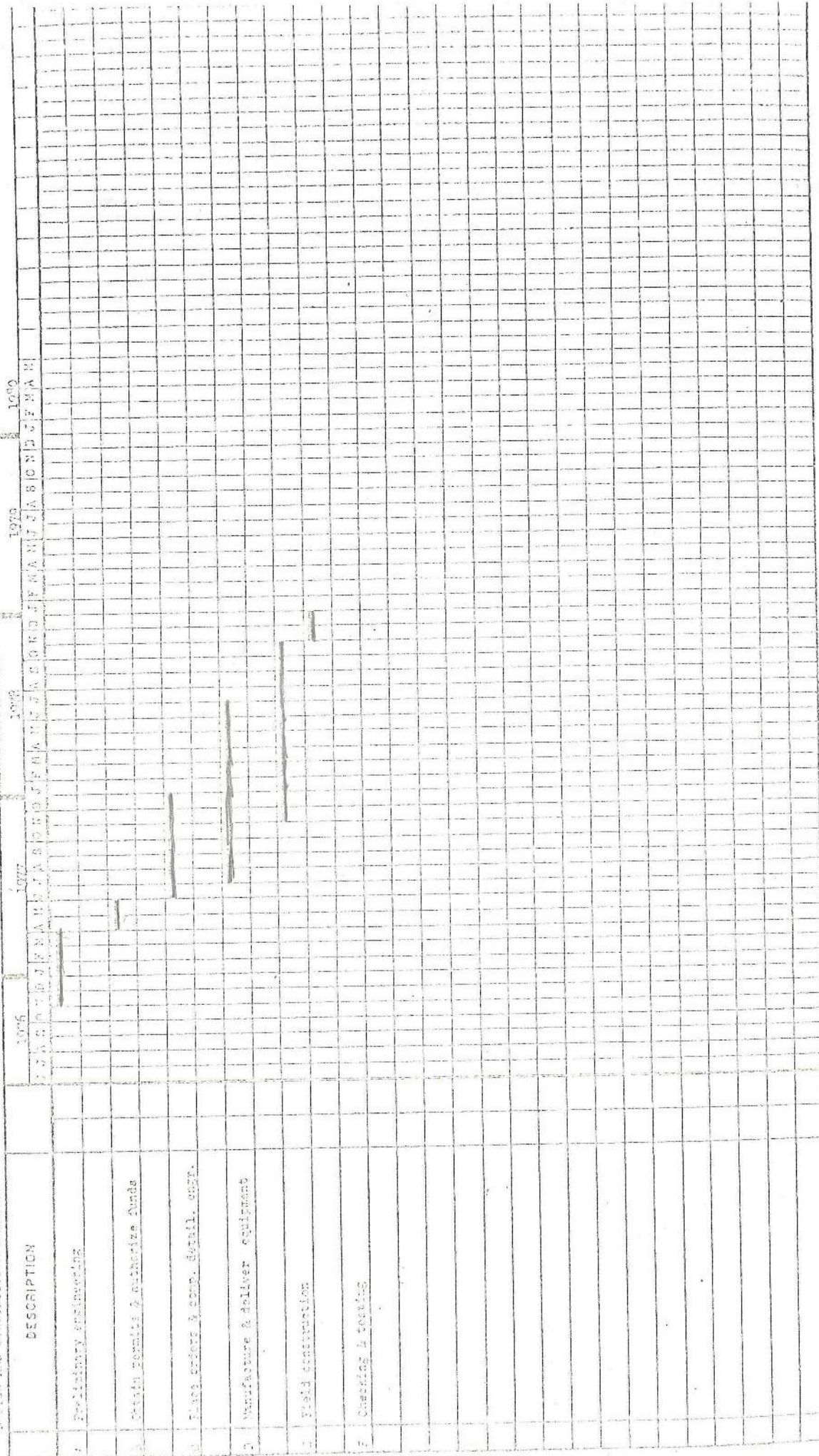
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PAV. & PAVEMENT MAINT.  
POTOMAC PLANT  
1974-1975

FIGURE 3 ATTACHMENT 10

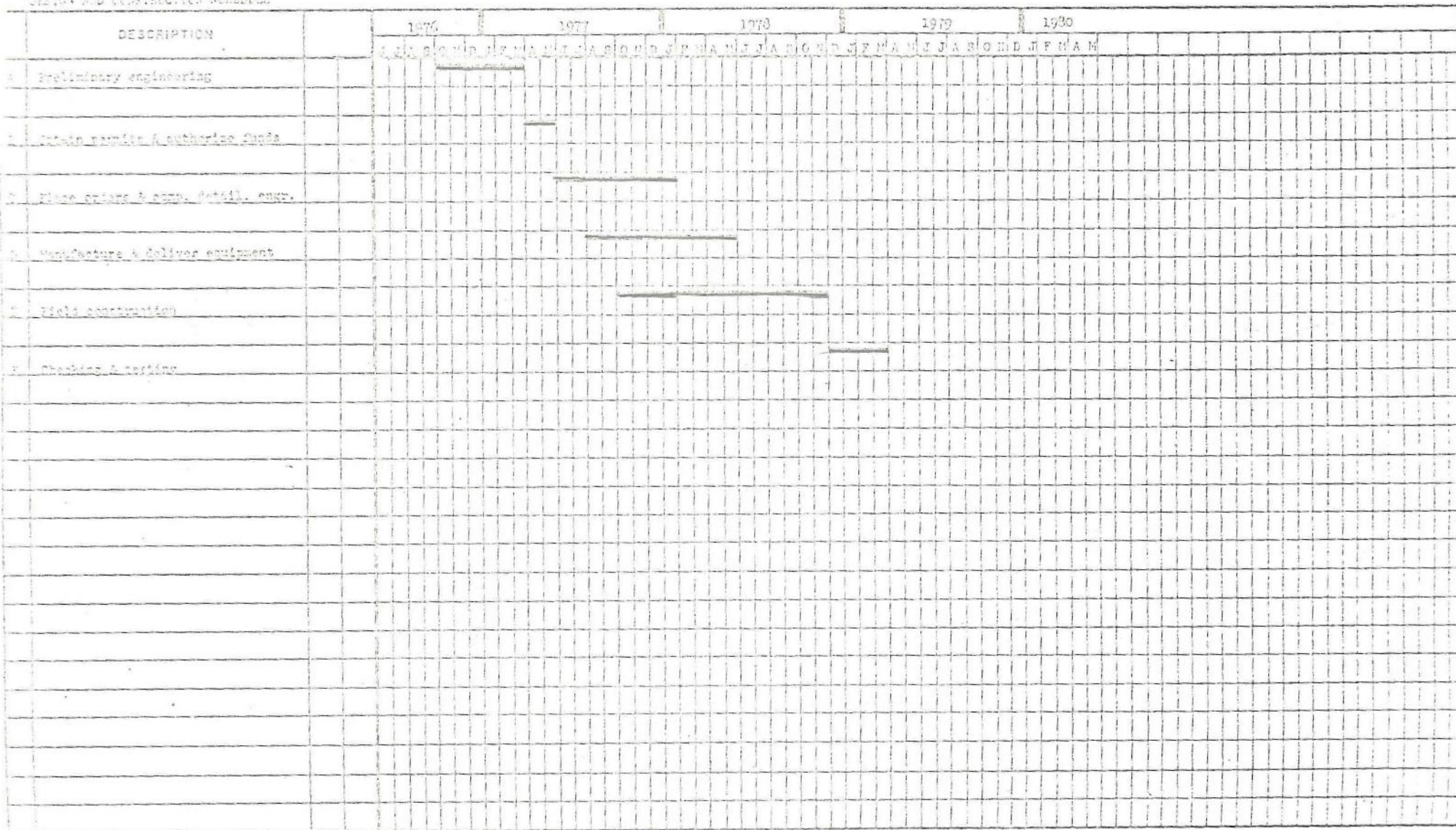
DESIGN AND CONSTRUCTION SCHEDULE



August 1975 12657



## OPERATION AND CONSTRUCTION SCHEDULE



August 26, 1976 WBF/arc

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[illegible]

12659



August 18, 1976

United States Steel Corporation  
600 East Grant Street  
Pittsburgh, Pennsylvania 15230

Attention: Mr. S. P. Curtis  
Vice President, Engineering

Subject: Revision No. 1; NALCO ES Proposal No. 76-224-C  
Project Consulting Services  
United States Steel Corporation  
Gary Works  
Gary, Indiana

Gentlemen:

At the request of United States Steel Corporation we are hereby revising Page -7- of our above referenced proposal to read as follows:

Section 4.0 Scope

An outline of the work and services to be provided by NALCO E.S. under the terms of this proposal to accomplish the objectives in Section 2.0, are presented below:

4.1 General

4.11 Flow Measurements to determine the total flow of industrial sewers GW-1, GW-2, GW-3 and GW-4 shall be conducted on a continuous basis (24 hours/day) for a period of fifteen (15) representative days,\* but in any event will be limited to a total of twenty (20) days on-site.

4.12 Contaminant Sampling to determine total contaminant loadings for each individual sewer shall consist of 24 hour composite samples for a period of fifteen (15) representative days,\* but in any event will be limited to a total of twenty (20) days on-site. Samples shall be collected using automatic sampling equipment.

4.13 Contaminant Sampling to establish point source contribution shall consist of 8 hour composite samples from all intermediate sampling points. Samples shall be collected using automatic sampling equipment.

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Mr. S. P. Curtis  
Vice President, Engineering  
United States Steel Corporation

Page 2

August 18, 1976

4.14 Analytical test methods, sample handling and preservation procedures for the specific contaminants under consideration are presented in Table 2.

- \* The definition of a representative day will have to be agreed upon by United States Steel Corporation and NALCO E.S. prior to commencing the on-site work.

Our definition for a representative day is limited to the following constraints: 1) No excessive, continuous rainfall and 2) normal or typical operations at the Coke Plant and Sinter Plant No. 3.

The above revisions to the scope of work necessitates an increase in the total cost to perform the services as outlined.

Our revised cost for providing the complete services as described in Section 4.0 of our proposal including the revision outlined above will not exceed incremental costs for additional on-site labor, travel and living expenses, equipment rental fees, additional analytical testing, transportation and data reduction.

We hope this information is sufficient for your immediate need. If there are any additional questions regarding our proposal, we will be pleased to answer them.

Very truly yours,

A. J. Young  
Section Head  
Project Consulting Services  
NALCO ENVIRONMENTAL SCIENCES

ASJ:mb

cc: Mr. James P. Gravenstreter

12661



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NALCO ENVIRONMENTAL SCIENCES  
1500 FRONTAGE ROAD • NORTHBROOK, ILLINOIS 60062 • AREA 312-564-0700

NALCO CHEMICAL COMPANY

August 11, 1976

United States Steel Corporation  
600 East Grant Street  
Pittsburg, PA 15230

Attention: Mr. S. P. Curtis  
Vice President; Engineering

Subject: NALCO ES Proposal No. 76-224-C  
Project Consulting Services  
United States Steel Corporation; Gary Works  
Gary, Indiana

Gentlemen:

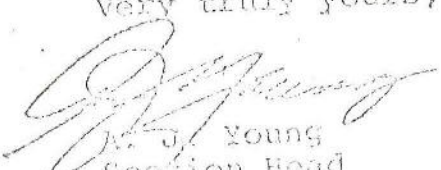
We are pleased to enclose herewith three (3) copies of our proposal to provide consulting services for U. S. Steel's Gary Works for your consideration.

Briefly, the scope of work discussed in more detail in the accompanying proposal includes a detailed survey of four major sewers emanating from the Gary Works Coke Plant and Sinter Plant No. 3, discharging into the Grand Calumet River. Our proposed work involves extensive flow measurement and detailed analytical testing.

The total cost for providing the complete services as described in Section 4.0 of the proposal is estimated at but will not exceed

We wish to thank U. S. Steel for the opportunity to present this proposal for consideration and are looking forward to the successful completion of the project. We will be pleased to discuss any aspect of this proposal in greater detail at your convenience.

Very truly yours,

  
A. J. Young  
Section Head  
Project Consulting Services  
NALCO Environmental Sciences

AJJ:pc

Enclosures

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PROPOSAL

PROJECT CONSULTING SERVICES  
FOR  
UNITED STATES STEEL CORPORATION.  
GARY WORKS  
GARY, INDIANA

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NALCO

PROPOSAL

PROJECT CONSULTING SERVICES  
FOR  
UNITED STATES STEEL CORPORATION  
GARY WORKS  
GARY, INDIANA

"Investigation of Coke Plant and Sinter  
Plant #3 Waste Discharges to Determine  
Point Sources Origin and Contamination  
Loadings"

Proposal Number 76-224-C  
August 11, 1976

12664

NALCO ENVIRONMENTAL SCIENCES  
1200 PONTIAC AVENUE, G. NORTHBRIDGE, ILLINOIS 60062

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### 3.0. PROJECT TEAM CONCEPT

A team of NALCO ENVIRONMENTAL SCIENCES personnel will be assigned to the project for work at the job site. The team will be under the direction of a project manager and a project leader experienced in all phases of primary metals waste disposal and treatment. The project manager will be responsible for all aspects of the study, including development of recommendations, schematic plans and a complete final report covering the entire study. The project leader will be the resident engineer in charge of all field activities.

In addition to this specific project team assigned to the site, additional people will be available from NALCO's Chicago Staff and the NALCO RESEARCH CENTER, as needed during the course of the project. This support is essential to the project manager, who may draw upon the experience and know-how available from approximately 300 researchers and 70 staff specialists.

The Research Center includes laboratory groups, which specialize in analyses of water and solids, water clarification, oil emulsion breaking, liquid/solids separation, as well as corrosion control and microbiology. The Chicago Analytical Laboratory will have a major part in the project inasmuch as it will handle all analyses. The Analytical Laboratory is equipped with such analytical instruments as atomic absorption spectrometers, total carbon analyzers and gas chromatographs. An electron microscope of the latest design is available.

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The Project Team will have at their disposal, portable instruments for continuous recording of pH, conductivity, temperature, and liquid level. The liquid level recorders may be used in connection with flow measurements and monitoring.

A team of specialists experienced in fluorometric flow measurement techniques, and equipped with instruments of advanced design will be an integral part of our project team.

NALCO's history includes a long list of water management and waste treatment studies in primary metals and related industries. Our background in water treatment, in general, both for industrial and municipal uses, together with our research and analytical facilities, enables us to undertake a project of this kind with complete confidence. A partial list of clients, people for whom we have conducted similar studies in the past, has been included in the Appendix.

### 3.1 Project Organization

A project organization chart for the U.S. Steel Corporation, Gary Works Industrial Sewer Survey is included in Figure 1. The proposed structure takes advantage of both pure and functional organization.

NALCO ES will commit a nucleus of experienced personnel to perform all the analytical testing required in support of the project.

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### 3.11 Project Staff

Resume's of the key personnel identified on the Project Organization Chart (Figure 1) are presented in Appendix D.

Additional members of the project will be selected on basis of availability. Resume's of the individuals who may be selected are also included in Appendix.

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NALCO ES ON/SITE PROJECT TEAM

NALCO  
CENTRAL ANALYTICAL  
LABORATORY

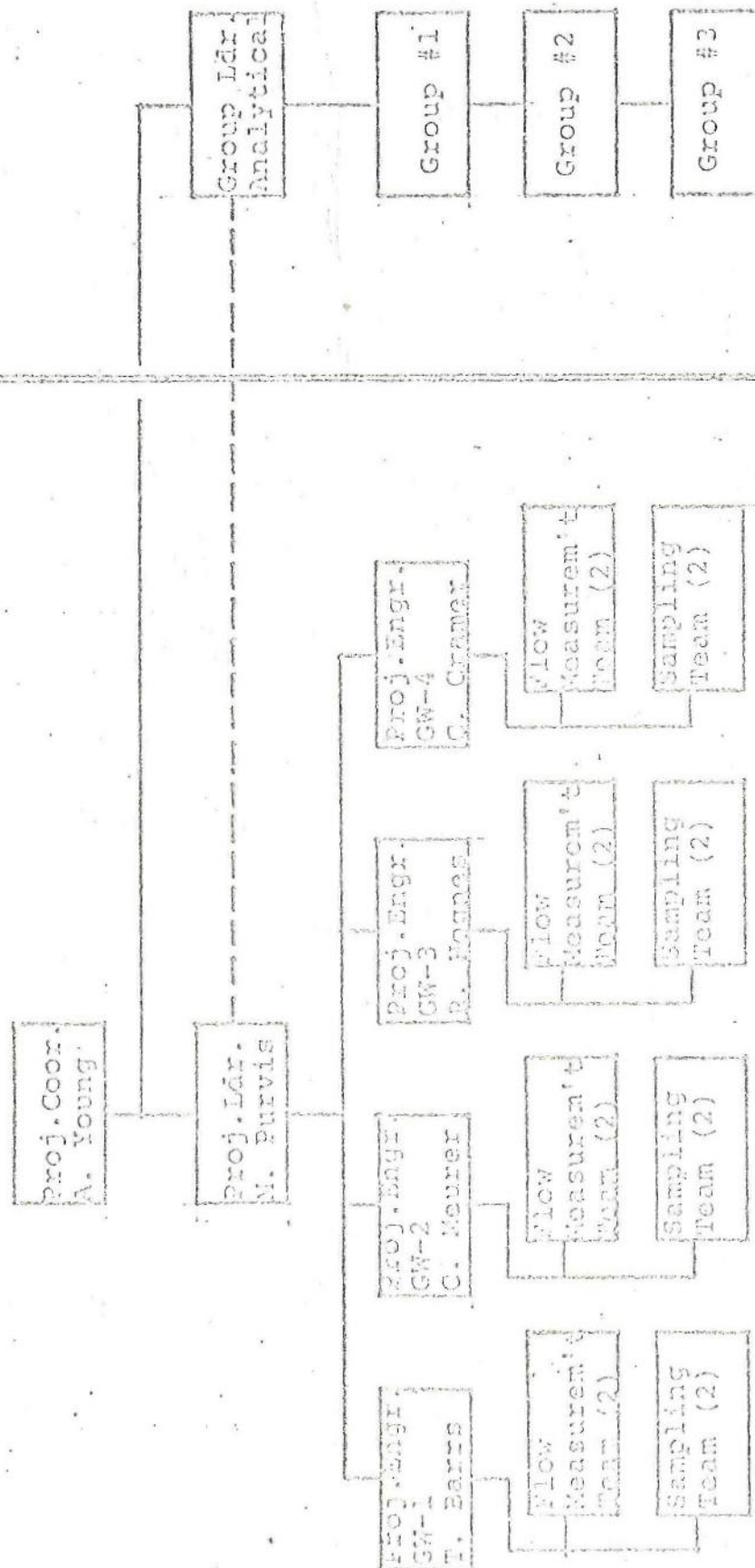


FIGURE 1. PROJECT ORGANIZATION CHART FOR THE U.S. STEEL CORPORATION, GARY WORKS INDUSTRIAL SEWER SURVEY

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4.0 SCOPE

An outline of the work and services to be provided by NALCO E.S. under the terms of this proposal to accomplish the objectives in Section 2.0, are presented below:

4.1 General

4.11 Flow Measurements to determine the total flow of industrial sewers GW-1, GW-2, GW-3 and GW-4 shall be conducted on a continuous basis (24 hours/day) for a period of fifteen (15) consecutive days.

4.12 Contaminant Sampling to determine total contaminant loadings for each individual industrial sewer shall consist of 24 hour composite samples.

Samples shall be collected using automatic sampling equipment.

4.13 Contaminant Sampling to establish point source contribution shall consist of 8 hour composite samples from all intermediate sampling points.

Samples shall be collected using automatic sampling equipment.

4.14 Analytical test methods, sample handling and preservation procedures for the specific contaminants under consideration are presented in

Table 2.

12672



#### 4.2 Flow Measurement - GW-1

- 4.21 Install continuous recording level indicators in each of the three (3) cells of the Tube Works Scale Pit. Establish the overflow weir geometry and determine flow contribution of the Tube Works to industrial sewer GW-1.
- 4.22 Inject Rhodamine WT dye solution at M.H. 9-C (See Figure 2, Schematic diagram - Industrial Sewer GW-1).
- 4.23 Sample and analyze continuously for Rhodamine WT dye concentration via a Turner Model No. P-111 fluorometer at a proposed access shaft to be constructed on GW-1 to determine total flow.
- 4.24 Sample and analyze for Rhodamine WT dye concentration at M.H. 8-C to determine flow contribution from the Tube Works.
- 4.25 Sample and analyze for Rhodamine WT dye concentrations at M.H. 6-C from lateral 7C East and lateral 7C West.
- 4.26 Sample and analyze for Rhodamine WT dye concentrations at M.H. 3-C to determine flow contribution from the Pump House connecting to M.H. 5-C the Pump Houses connecting to M.H. 3-C and the yard drainage sump connecting to M.H. 3-C-1.

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- 4.27 Sample and analyze for Rhodamine W.T. dye concentrations at proposed access shaft to be constructed to determine contribution from lateral 2-C East.

4.3 Contaminant Sampling And Analysis - GW-1

- 4.31 Sample and analyze for Ammonia, Chlorides, Total Cyanide, Oil and Grease, Phenol and Total Suspended Solids at the following locations:

4.311 M.H. 8-C; Tube Works contribution, (24 hour composite samples).

4.312 M.H. 6-C; Lateral 7C East and 7C West contribution (8 hour composite samples).

4.313 M.H. 3-C; Contributions from Pump House connecting to M.H.S.C. Pump Houses connecting to M.H. 3-C, and the yard drainage sump connecting to M.H. 3-C (8 hour composite samples).

4.314 M.H. 2C-2; Lateral 2C East Contribution. (8 hours composite samples).

4.315 Proposed access shaft; total contaminant loading of industrial sewer GW-1 (24 hour composite samples).

4.4 Flow Measurement - GW-2

- 4.41 Inject Rhodamine W.T. dye solution at M.H. 6B-7 and/or M.H. 5B-8. (See Figure 3, Schematic Diagram - Industrial Sewer GW-2).

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- 4.42 Sample and analyze continuously for Rhodamine W.T. dye concentrations via a Turner Model No. F-111 fluorometer at either the Oil Collection Sump or M.H. 1B-A to determine total flow of industrial sewer GW-2.
- 4.43 Sample and analyze for Rhodamine W.T. dye concentration at M.H. 6B-3 to determine flow contribution of Lateral 6B West.
- 4.44 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. 5B-1 to determine flow contribution of a portion of Lateral 6B East.
- 4.45 Sample and analyze for Rhodamine W.T. dye concentration at M.H. 5B to determine flow contribution of Lateral 6B East as well as flow contribution of Lateral from the Tar Centifuge pit.
- 4.46 Sample and analyze for Rhodamine W.T. dye concentration at M.H. 4B to determine flow contributions of Lateral 4B West.
- 4.47 Install continuous level recorder at Oil Collection Sump to establish a correlation to total flow of GW-2.
- 4.5 Contaminant Sampling and Analysis - GW-2 12675
- 4.51 Sample and analyze for Ammonia, Chlorides, Total Cyanide, Oil and Grease, Phenol and Total Suspended Solids at the following locations:



- 4.511 M.H. 5B-8; Contribution from Oil Sump (8 hour composite samples).
- 4.512 M.H. 5B-1; Lateral 5B North. (8 hour composite samples).
- 4.513 M. H. 6B-3; Lateral 6B East and Lateral 6B West contribution (8 hour Composite samples).
- 4.514 M.H. 5B; Laterals 5B, 6B East and connection from the Tar Centifuge Pit. (8 hour composite samples).
- 4.515 M.H. 4B-3; Lateral 4B West contribution (8 hour composite samples).
- 4.516 M.H. 4B-1; Contribution of Sump adjacent to M.H. 4B-1 and the remaining portion of Lateral 4B West. (8 hour composite samples).
- 4.517 M.H. 4B; Lateral 4B West contribution (8 hour composite samples).
- 4.518 M.H. 1-BA; Total contaminant loading of industrial sewer GW-2. (24 hour composite samples).

4.6 Flow Measurement - GW-3

- 4.61 Install a weir and continuous recording level indicators in the Oil Collection Sump located prior to outfall on industrial sewer GW-3 to determine total flow.

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- 4.62 Inject Rhodamine W.T. dye solution at M.H. 7A-14 (See Figures 4, and 5, Schematic Diagrams - Industrial Sewer GW-3).
- 4.63 Sample and analyze continuously for Rhodamine W.T. dye concentration via a Turner Model No. F-111 Fluorometer at the Oil Collection Sump to determine total flow.
- 4.64 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. 7A-5 to determine flow contributions from Open Hearth and Specifications Facilities.
- 4.65 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. 7A-2 to determine any environmental flow contributions to Lateral 7A between M.H. 7A-5 and M.H. 7A-2.
- 4.66 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. 7A to determine flow contributions from Laterals 7A East and 7A West.
- 4.67 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. 3A-A to determine flow contributions from Lateral 4A, Lateral 4AA and Lateral 6A.
- 4.68 Sample and analyze for Rhodamine W.T. dye concentrations at the Oil Collection Sump to determine flow contribution from Lateral 2A.

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#### 4.7 Contaminant Sampling and Analysis - GW-3

4.71 Sample and analyze for Ammonia, Chlorides, Total Cyanide, Oil and Grease, Phenol and Total Suspended Solids at the following locations:

- 4.711 M.H. 7A-8; Barometric Condenser contribution (8 hour composite samples).
- 4.712 M.H. 7A-7; Lateral 7A East and Lateral 7A North contributions (8 hour composite samples).
- 4.713 M.H. 7A-5; Open Hearth and Specification Pitch Facilities contribution (8 hour composite samples).
- 4.714 M.H. 7A-2; Coal Chemical Recovery Department contribution (8 hour composite samples).
- 4.715 M.H. 7A; Lateral 7A East and 7A West contribution (8 hour composite samples).
- 4.716 M.H. 3AA; Lateral 6A East, Lateral 4AA and Lateral 4A contributions (8 hour composite samples).
- 4.717 Oil Collection Sump; Total contaminant loading of industrial sewer GW-3 (24 hour composite samples).
- 4.718 Oil Collection Sump; Lateral 2A Contribution (24 hour composite samples).

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4.8 Flow Measurement - GW-4

- 4.81 Install a weir and continuous recording level indicators at the outfall of industrial sewer GW-4 to determine total flow.
- 4.82 Inject Rhodamine W.T. dye solution at M.H. SM-1 (See Figure 6, Schematic Diagram - Industrial Sewer GW-4).
- 4.83 Sample and analyze continuously for Rhodamine W.T. dye concentrations via a Turner Model No. F-111 fluorometer at either M.H. SM-9 or the river outfall.
- 4.84 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. SM-2 to determine flow contribution from Ignition Hood Cooling.
- 4.85 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. SM-3 to determine flow contributions from I.D. Fan Cooling.
- 4.86 Sample and analyze for Rhodamine W.T. dye concentrations at SM-5 to determine flow contributions from West Lateral of Sinter Plant Sewer.
- 4.87 Inject Rhodamine W.T. dye solution at M.H. SM-7 (See Figure 6, Schematic Diagram - Industrial Sewer GW-4).
- 4.88 Sample and analyze for Rhodamine W.T. dye concentrations at M.H. No. 2 to determine flow contribution from compressor cooling.

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NATCO

4.9 Contaminant Sampling and Analysis - GW-4  
4.91 Sample and analyze for Ammonia, Chloride, Total  
Cyanide, Oil and Grease, Phenol, Sulfates and  
Total Suspended Solids at the following locations:  
4.911 M.H. SM-2; Ignition Hood Cooling Con-  
tribution (8 hour composite samples).  
4.912 M.H. SM-3; I.D. Fan Cooling contribution  
(8 hour composite samples).  
4.913 M.H. SM-5 Drain from Sinter Screening  
Building contribution. (8 hour composite  
samples).  
4.914 M.H. SM-9; total contaminant loading of  
Industrial sewer GW-4 (24 hour composite  
samples).  
4.915 M.H. #2; Compressor Cooling contribution  
(8 hour composite samples).  
4.10 Contaminant Sampling and Analysis - Pump Station  
Service Water Intake  
4.101 Sample and analyze for Ammonia, Chloride, Total  
Cyanide, Oil and Grease, Phenol, Sulfates and  
Total Suspended Solids at the Service Water  
Intake (24 hour composite samples).

RECEIVED ENVIRONMENTAL CONCERNS  
1000 FLOUVEAU ROAD, A. MONTREAL, QUEBEC H3T 1B6

# SAMPLING AND ANALYTICAL TEST SCHEDULE

Sensor	Sampling Location	Sample Type	Test Parameter	Day															Remarks	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
GV-1	M.H. 8-C	24 Hr C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GV-1	M.H. 6-C	8 Hr C	SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GV-1	M.H. 3-C	8 Hr C	O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GV-1	M.H. 2-C	8 Hr C	Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GV-1	Access Shaft	24 Hr C	TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GV-1			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

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# SAMPLING AND ANALYTICAL TEST SCHEDULE

Sever	Sampling Location	Sample Type	Test Parameter	Day															Remarks
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
GW-2	M.H. 5B-3	S H= C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-2	M.H. 5B-1	S H= C	TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-2	M.H. 6B-3	S H= C	SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-2	M.H. 5B	S H= C	Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-2	M.H. 4B-3	S H= C	O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

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Sewer	Sampling Location	Sample Type	Test Parameter	Day															Remarks	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
CW-2	M.H. 4B-1	S Hz C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CW-2	M.H. 4B	S Hz C	SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CW-2	M.H. 1-2A	24 Hz C	O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CW-3	M.H. 7A-S	S Hz C	Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CW-3	M.H. 7A-7	S Hz C	TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

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Server	Sampling Location	Sample Type	Test Parameter	Day															Remarks	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
GW-3	M.H. 7A-5	8 Hr. C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-3	M.H. 7A-2	8 Hr. C	TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-3	M.H. 7A	8 Hr. C	SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-3	M.H. 3AA	8 Hr. C	Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GW-3	Oil Collection Sump	24 Hr. C	O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			TSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

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# SAMPLING AND ANALYTICAL DATA SUMMARY

Sever	Sampling Location	Sample Type	Test Parameter	Day															Remarks
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
GN-1	M.H. 89	24 Hr C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GN-2	M.H. SN-2	3 Hr C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GN-3	M.H. SN-3	3 Hr C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GN-4	M.H. SN-5	3 Hr C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
GN-5	M.H. No. 2	3 Hr C	NH3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Cl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			CN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			O&G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			Phenol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			SO4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

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## SAMPLING AND ANALYTICAL TEST SCHEDULE

Sampling Location	Sample type	Test Parameter	Day														Remarks		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14		15	
Pump Station	24 Hr C	NH3																	
		Cl																	
		CN																	
		OSG																	
		Phenol																	
		SO4																	
		TSS																	

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TABLE 2

METHODS FOR CHEMICAL ANALYSIS  
OF  
WASTEWATER

ANALYSIS	CODE	DEFINITION	METHOD	DETECTION LIMIT, mg/l	SAMPLE SIZE, ml	CONTAINER (P=Polystyrene, G=Glass)	PRESERVATION
Ammonia (NH <sub>3</sub> )	NH <sub>3</sub>	Evolvable ammonia nitrogen	Nesslerization or titration with standard acid	0.2	100	G	10 ml 10% H (solution & per liter
Chloride (Cl)	CL	Soluble chloride ion concentration	Titration with silver nitrate - Chromate indicator	1	50	P	none
Cyanide (CN) - Free and Combined	CN	Free and combined Cyanide	Distillation - ion- selective electrode colorimetric (pyridine-pyrazolone) or titration with silver nitrate	0.01	1 liter	G	Raise pH to 11 with 1N (solution)
Oil and Grease - Free	Oil	Free extractable- non-volatile at 70°C	Acidification-Liquid Liquid extraction with freon-Gravimetric determination	1	1 liter	G	10 ml 10% H (solution per liter
Phenols	PH <sub>2</sub>	Phenols reacting with 4-aminoanti- pyrine	Distillation- Colorimetric (4-aminoanti- pyrine)	0.001	1 liter	G	5 ml 20% C (solution lower pH & than 4 wit H <sub>3</sub> PO <sub>4</sub> (sol 902). Keep cool. Ship diately.
Solids- Total Suspended	SS	Total non-filterable residue-Nonvolatile at 105°C	Millipore filtra- Gravimetric deter- mination-Tried at 105°C.	5	200	G	none
Sulfate (SO <sub>4</sub> )	SO <sub>4</sub>	Soluble sulfate	Turbidometric	2	50	P	none

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TABLE 3

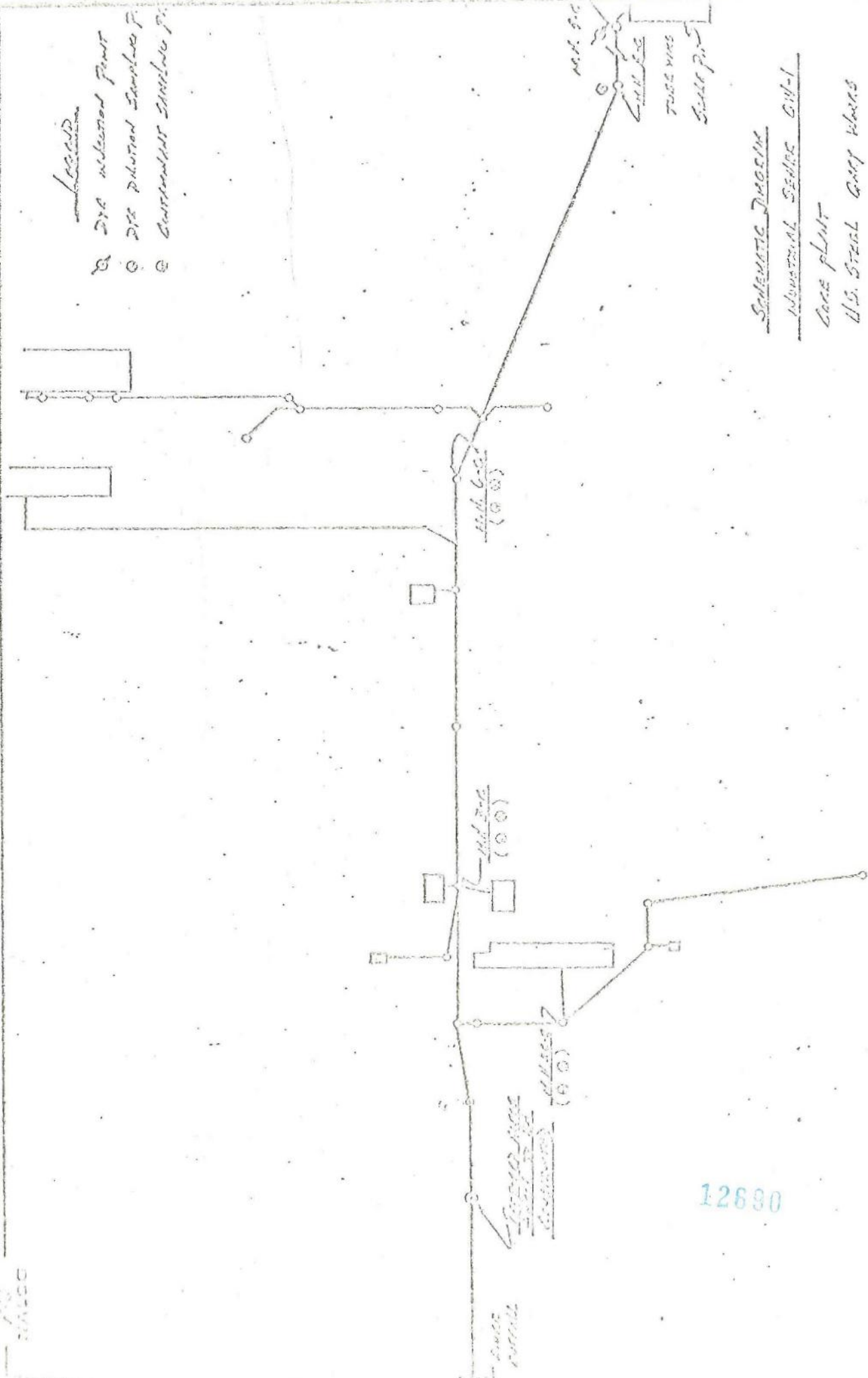
FLOW MEASUREMENT TEST SCHEDULE

Station	Sampling Location	Day															Remarks
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
CW-1	M.H. 8-C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 6-C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 3-C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	Proposed Access Shaft	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Continuously
GW-2	M.H. 6B-3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 5D-1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 5B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 4B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
CW-3	Oil Collection Sump	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Continuously
	M.H. 7A-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 7A-2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 7A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
CW-4	M.H. 3A-A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	Oil Collection Sump	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Continuously
	M.H. 6M-2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 6M-3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 6M-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 6M-2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Intermittent Samples During Daylight Shift
	M.H. 6M-9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Continuously

126888

5.0 INDUSTRIAL SEWER DIAGRAMS

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Legend  
 D.C. indicated point  
 D.C. physical location P.  
 D.C. current location P.

Schematic Diagram  
Monetary Series C-1  
 Case Plot  
 U.S. Steel Corp. Plans

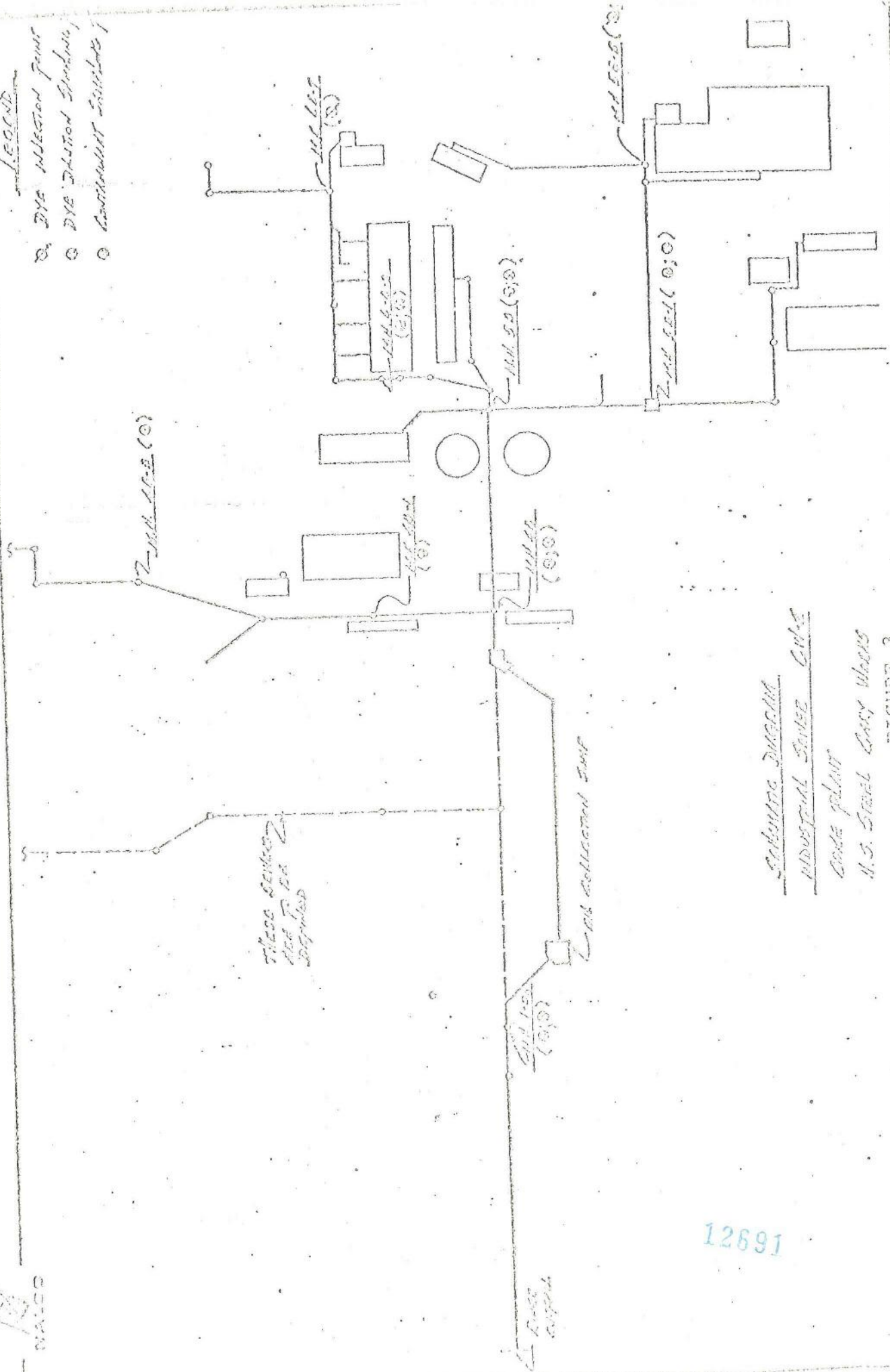
FIGURE 2



11

1800

- ② DYE INJECTION Faint
- ③ DYE INJECTED Good No.
- ④ Goodishst. Satisfactory



code plant  
zone protected  
persons authorized

U.S. Steel Corp. Works

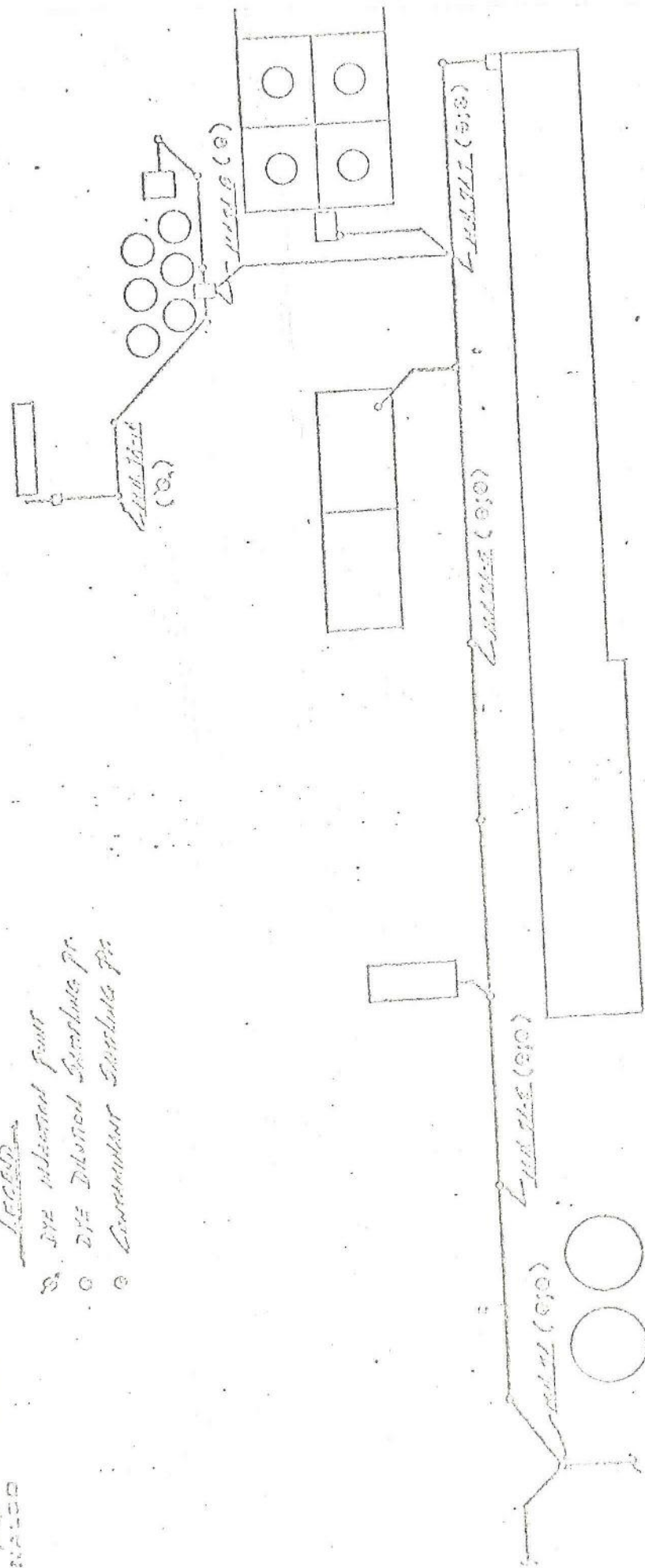
3  
FUGUES

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Legend

- 3/4" Industrial Fuel
- 3/4" Industrial Fuel
- 3/4" Industrial Fuel



General Industrial  
Industrial Fuel G-1-E  
Core Plant  
U.S. Steel Corp. Works

FIGURE 4

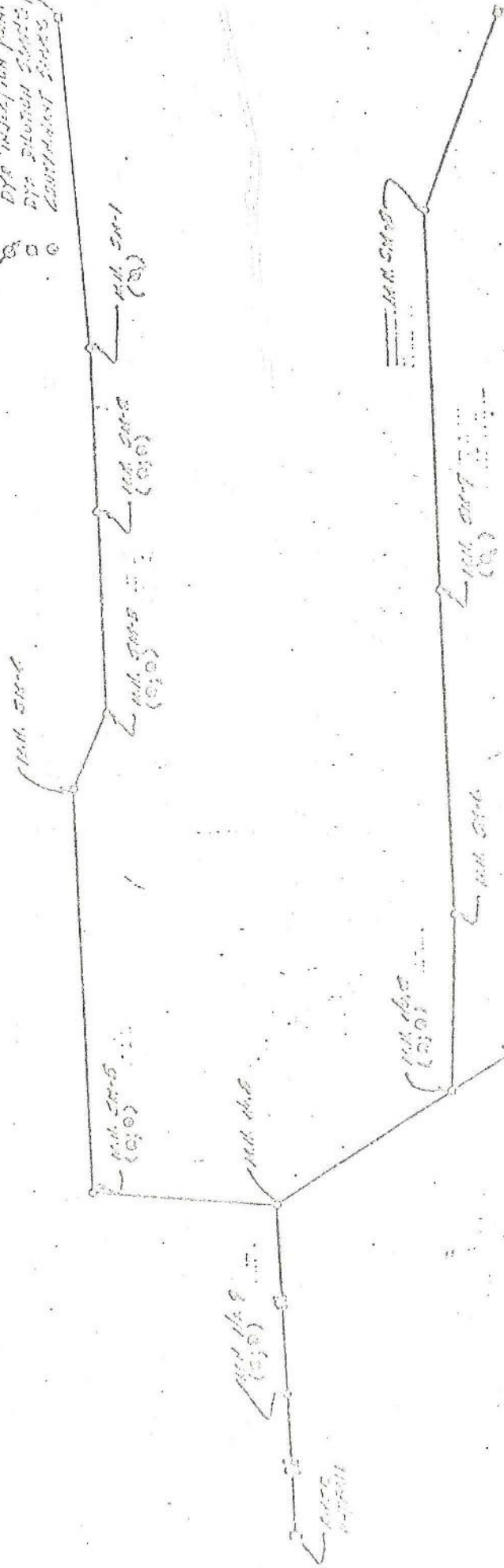
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# LEGEND

Dye Indication Point  
 Dye Station Number  
 Contaminant Source



SCHEMATIC DIAGRAM  
 INDUSTRIAL SERVICE C.W.-A  
 WATER PLANT #3  
 U.S. STEEL, Gary Works

NALCO ENVIRONMENTAL SCIENCES 1500 FRONTAGE ROAD NORTHMOORE, ILLINOIS 60062		DRAWING NO.
DATE: 8-8-76	SCALE:	DRAWN BY:
REVISION:	APPROVED:	CHECKED:

12694

FIGURE 6

## 6.0 UNITED STATES STEEL RESPONSIBILITY

- 6.1 Provide manhole covers, as required, with access ports for entry of sampler tubing into sewers.
- 6.2 Provide NALCO ES a designated staging area, with telephone, of 600 square feet, suitable for bottle and equipment storage and computer terminal operation. A direct telephone line is preferable.
- 6.3 Provide barricades, etc., as deemed necessary by U.S. Steel, to mark off sampling equipment or for safety purposes at manholes fitted with sampling lines.
- 6.4 Provide designated area for data transferal at a specified time each morning beginning 48 hours after collection of the first days samples.
- 6.5 Construct and place weirs in Oil Collection Pit on Sewers GW-3. Construct and place weir in outfall of sewer GW-4. NALCO ES will provide weir designs.
- 6.6 Provide safe access into both Oil Collection Pits above, as well as the weir sections of the Tube Mill Scale Pit to calibrate liquid level recorders to be installed behind weirs. NALCO ES to provide gas masks, etc., as required.

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6.7 Provide the following specific and detailed drawings.

6.71 Permanent installations at Coke Works.

6.72 Oil Collection Sumps.

6.73 Tube Works Settling Pit.

6.74 Outfall Structure Details (GW-1, GW-2, GW-3 and GW-4).

6.75 Four (4) copies of U.S. Steel Drawing No. 111160.

6.8 Provide permanent passes for the duration of the Project for all NALCO ES personnel and vehicles assigned to Project.

6.9 Information of procedures concerning OSHA requirements at the STEEL MILL.

7.0 Provide any other information, drawings, material, and services deemed necessary to expedite job.

7.1 locate all designated manholes and procure access for flow measurement and sampling equipment.

7.2 Provide key U.S. Steel liason for initial equipment set up and for coordination with NALCO ES during course of project.

12696





BETZ ENVIRONMENTAL ENGINEERS, INC.

ONE PLYMOUTH MEETING MALL • PLYMOUTH MEETING, PENNA 19462 • TELEPHONE: 215 • 625-3800

Please reply to:  
William J. Murdoch Engineers, Inc.  
Room 911  
Chamber of Commerce Building  
411 Seventh Avenue  
Pittsburgh, Pennsylvania 15219  
Telephone: 412-391-4822

August 13, 1976

Mr. S. P. Curtis  
Vice President Engineering  
United States Steel Corporation  
600 Grant Street  
Pittsburgh, Pennsylvania 15230

Subject: Comprehensive Study of Gary Works  
Outfalls GW-6, GW-7, GW-13, GW-L1,  
GW-L1A and ST-L5  
B.E.E. Proposal No. R358-76-2-1-BW

Dear Mr. Curtis:

Confirming our discussion in your office on August 12, we are submitting the enclosed proposal for professional service relating to a comprehensive study of the outfalls of the power house and blast furnances at Gary Works.

This revised proposal has been expanded in scope to meet your requirements for the study. We have elected to stay with the random grab samples as this will develop a better data base on what is going on in the plant as opposed to compositing samples on the 8-hour daylight shift.

We have selected September 7 to September 25 as the ideal testing period and during that time we expect no more than three days when it will rain, thereby, giving you the 15 representative days for meaningful data.

As indicated in the cover letter of our previous proposal, this survey is still flexible and will meet your needs should they change during the designated study period.

If you have any questions on the enclosed proposal or if I can be of any further service to you, please let me know.

Very truly yours,

*Basil G. Louros*  
Basil G. Louros  
Midwestern Regional Manager

12697

Mr. Joseph A. Lanoy - USS  
Mr. James Dickerson - USS

PROPOSAL

TO

UNITED STATES STEEL CORPORATION  
PITTSBURGH, PENNSYLVANIA

FOR

COMPREHENSIVE STUDY OF GARY WORKS  
OUTFALLS GW-6, GW-7, GW-13,  
GW-11, GW-11A, ST-L5 AND  
INTAKE SOURCES, PUMP HOUSES NO. 1 AND NO. 2

B.E.E. PROPOSAL NO. R358-76-2-1-MW

AUGUST 13, 1976

PREPARED BY:

  
B. G. LOUROS  
MIDWESTERN REGIONAL MANAGER

BETZ ENVIRONMENTAL ENGINEERS, INC.  
911 CHAMBER OF COMMERCE BUILDING  
411 SEVENTH AVENUE  
PITTSBURGH, PA 15219

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It is the understanding of Betz Environmental Engineers, Inc. (B.E.E.) that United States Steel Corporation (USS) requests characterization of two intake sources and several discharges at the Gary, Indiana plant. The intake sources are #1 and #2 pump houses. The water outfalls are identified as GW-6, GW-7, GW-10, GW-L1, GW-L1A and ST-L5.

Particular concern are discharge systems GW-6 and GW-7. A Mass balance is to be performed on these two discharge networks for oil and grease, suspended solids, phenol, cyanide, ammonia and flow. All other discharges require flow measurements, suspended solids and oil and grease. The two intake sources will be characterized for suspended solids, oil and grease, phenol, cyanide, and ammonia. The objectives of this characterization survey are (1) to determine the incremental change (if any) across the Mill for the selected constituents and (2) the source location of that which is causing the change described above in the discharge networks of GW-6 and GW-7. The sampling survey is to be performed over 18 consecutive days in order to obtain fifteen representative (dry) days. It is B.E.E.'s opinion that the period of September 7, 1976 to September 25, 1976 will offer the fifteen representative days. Should rainy weather persist during that period and fifteen representative (dry) days of data cannot be obtained, this will constitute a Change of Scope, and if additional sampling and analysis is required, will be billed on the basis of cost incurred (see basis of contract paragraph).

#### SCOPE OF WORK

Work to be performed is divided into Sampling Methodology and Location.

- A. Sampling Methodology - Water samples for laboratory analyses will be collected either as 24-hour composites or random grabs. Flow measurements will be performed through the lithium dilution method.
  1. 24-hour composites - Composite samples will be collected at all outfalls and the two intake sources handled properly for the required analyses.
  2. Random Grab - At in-plant selected sampling points two random grab samples will be collected daily. Over the 15 day period, this represents a total of 30 samples per sample point. The 30 random grab samples represent a significant population for statistical analyses.

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3. Flow Measurement - Instantaneous flow measurements will be performed employing the lithium dilution technique. A concentrated solution of lithium chloride is fed into the head end of the sewer at a known rate and concentration. Samples of diluted lithium are collected downstream after adequate mixing. These samples are analyzed for lithium, and the flow is determined using the following equations:

$$Q_2 = C_1 \times Q_1 / C_2$$

Where  $C_1$  = Initial lithium concentration  
 $Q_1$  = Flow rate of lithium solution  
 $C_2$  = Lithium concentration in sample  
 $Q_2$  = Flow rate

This approach permits flow measurement at each sampling point along the sewer system.

4. Laboratory Analyses - All analyses will be performed according to the procedures currently accepted by the United States Environmental Protection Agency. For continuity with existing USS data, the procedures currently used by the laboratory at Gary will be recognized. The analytical results will be available within 48 hours after sample collection.
- B. Sampling Location - The sampling locations are described as either an individual site or points along a discharge network.
1. GW-6 Discharge Network - The combined discharge is approximately 40 MGD. There are approximately 20 accessible manholes. B.E.E. proposes to sample at 20 locations along the main branch. The combined discharge will be sampled with both 24-hour compositing and random grab sampling.
  2. GW-7 Discharge Method - The combined discharge is approximately 35 MGD. There are about 10 accessible manholes. B.E.E. proposes to sample at these 10 points.
  3. Pump House #1 and #2 - These two intake sources will be sampled with 24-hour composites and random grab samples.

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4. GW-13 - This discharge averages about 4 MGD. Since there is little existing data on this discharge network, B.E.E. proposes to sample at 8 locations. The outfall will be sampled with 24-hour composites. All other sampling will be random grabs.
5. GW-L1 and L1A - The GW-L1 and L1A outfall discharge approximately 80 and 60 MGD, respectively. Although these discharge networks carry large volumes of water, they are typically good quality effluents. B.E.E. proposes to sample GW-L1 and L1A at 4 and 5 locations, respectively. This sampling is to confirm the quality of these discharges. The outfalls will be sampled through 24-hour compositing. All other samples will be random grabs.
6. ST-L5 - In comparison, the 2.5 MGD discharge through outfall ST-L5 is a minor flow. B.E.E. proposes to confirm the quality of this discharge through sampling at 4 locations. As with the other discharge networks, 24-hour composites will be collected at the outfall. The remainder of the sampling is random grabs.

#### BASIS OF CONTRACT

It is proposed that the above outlined services be performed on the basis of per diem charges for Betz Environmental Engineers' personnel plus direct expenses. Only those costs incurred will be charged, but they will not exceed the ESTIMATED PROBABLE COST without United States Steel Corporation's approval. We expect the ESTIMATED PROBABLE COST will cover fully the services herein described.

ESTIMATED PROBABLE COST. . . . .

A copy of per diem rates and analytical charges are attached.

#### WORK SCHEDULE

Authorization to begin this project should be received by B.E.E. prior to August 30, 1976 so that necessary laboratory and equipment arrangements can be made so the sampling program can begin promptly on September 7, 1976.

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## DELINEATION OF SERVICES

For this project, B.E.E. will utilize an Engineering Team Concept. This Team will consist of the following:

- A. Senior Principal Engineer - Who will provide overall project management, provide liaison with U.S.S. Engineering in Pittsburgh and present B.E.E.'s findings and recommendations
- B. Project Engineer - Who will direct the field survey review all data collected and prepare a report detailing B.E.E.'s findings and recommendations.
- C. Assistant Project Engineer (3) - Who will conduct the sampling and  
Assistant Engineer (3) flow measurement program, trace  
Engineering Technician (4) sewers and assist in preparation of data.

## DELAYS

Delays caused by unforeseen occurrences such as unfavorable weather conditions, plant shutdowns (partial or complete), strikes, floods or fires which extend the effort resulting from such delays will be billed on a basis of our current Schedule of Per Diem Charges plus direct expenses.

## PAYMENT

Invoices will be submitted for work completed on a monthly basis, with terms net 30 days with past due balances subject to interest at the rate of one (1) percent per month, effective 45 days after date of invoice. This represents an annual interest charge of twelve (12) percent.

## PROPOSAL VALIDITY

It is understood that this proposal is valid for 30 days. Subsequent to that date, B.E.E. reserves the right to review the basis of payment to allow for changing costs and adjust starting and completing dates to conform to work load if need be.

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## INSURANCE

Betz Environmental Engineers, Inc. will maintain insurance coverage in the following amounts and upon request of the client, will provide a Certificate of Insurance so indicating:

	<u>Limit of Liability</u>
Workmen's Compensation	\$ 100,000 Statutory
General Liability	
Bodily Injury	\$1,000,000 each occurrence
	\$1,000,000 aggregate for products
Property Damage	\$ 500,000 each occurrence
	\$ 500,000 aggregate
Automobile	
Bodily Injury	\$1,000,000 each person
	\$1,000,000 each accident
Property Damage	\$1,000,000 each accident

## SAFETY

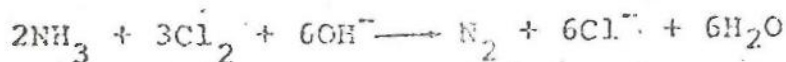
B.E.E. personnel always endeavor to conduct field activities in such a manner as to protect themselves and others from accidents and injury. When special safety equipment is required, the client should so specify. Normally, B.E.E. personnel will use their own safety equipment (hard hats, goggles, etc.) unless instructed to do otherwise.

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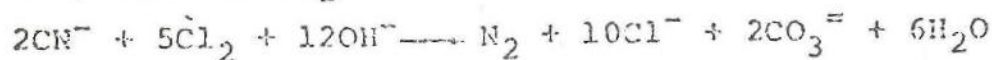
Table VI

Equations for Chlorine Consumption in the Alkaline  
Chlorination of Various Wastewater Components

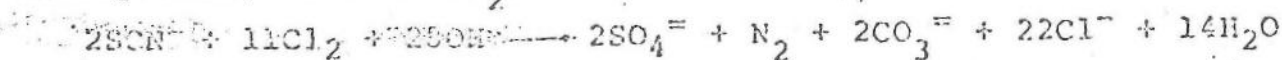
Ammonia-nitrogen, 7.60 lb Cl<sub>2</sub>/lb NH<sub>3</sub>-N



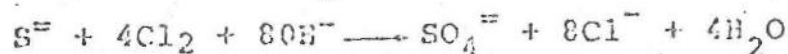
Cyanide, 6.82 lb Cl<sub>2</sub>/lb CN<sup>-</sup>



Thiocyanate, 6.72 lb Cl<sub>2</sub>/lb SCN<sup>-</sup>



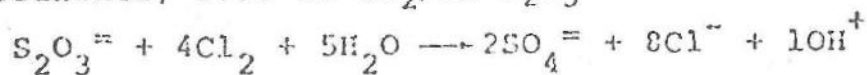
Sulfide, 8.83 lb Cl<sub>2</sub>/lb S<sup>=</sup>



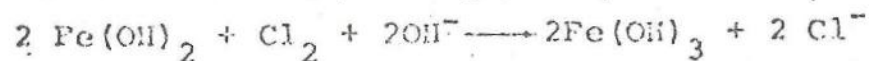
Sulfite, 0.89 lb Cl<sub>2</sub>/lb SO<sub>3</sub><sup>=</sup>



Thiosulfate, 2.53 lb Cl<sub>2</sub>/lb S<sub>2</sub>O<sub>3</sub><sup>=</sup>



Iron (ferrous), 0.63 lb Cl<sub>2</sub>/lb Fe<sup>++</sup>



Phenol, 2.26 lb Cl<sub>2</sub>/lb phenol

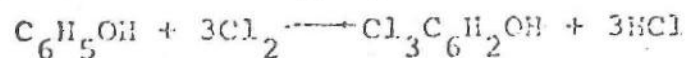
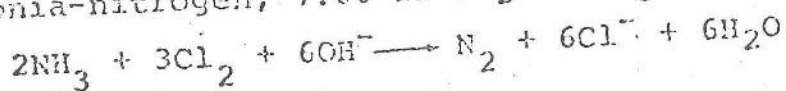


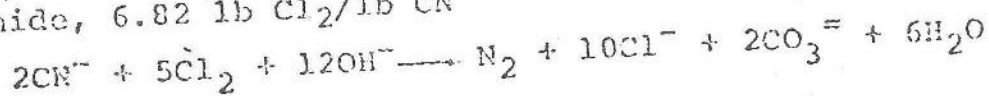
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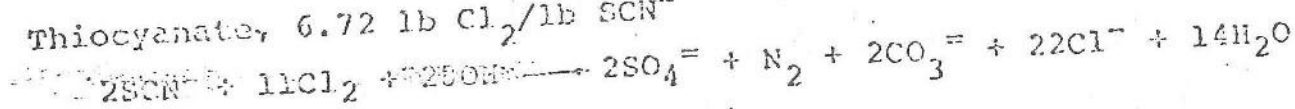
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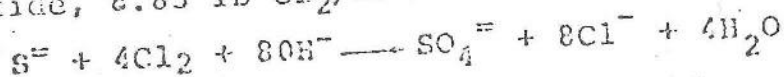
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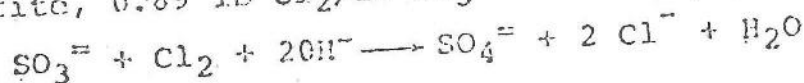
Thiocyanate, 6.72 lb Cl<sub>2</sub>/lb SCN<sup>-</sup>



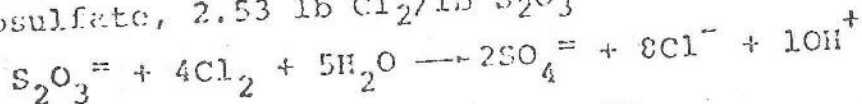
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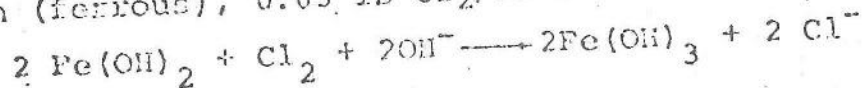
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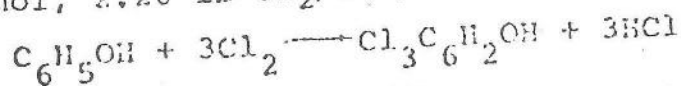
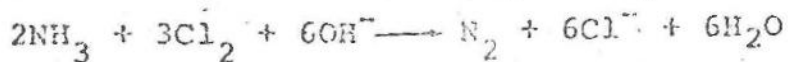




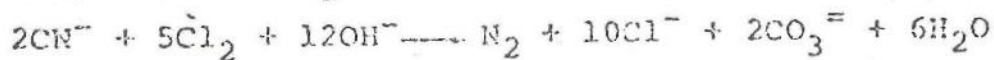
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Chlorination of Various Wastewater Components

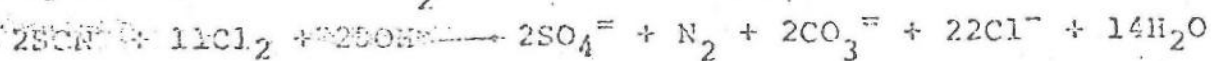
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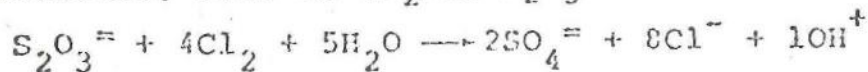
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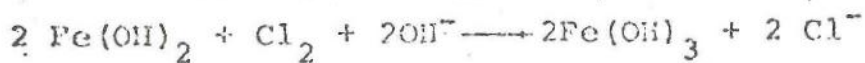
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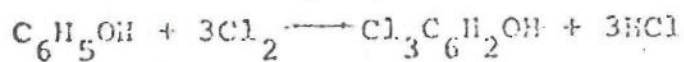


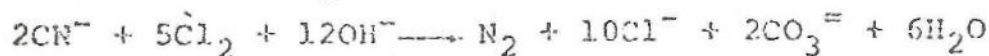
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Equations for Chlorine Consumption in the Alkaline Chlorination of Various Wastewater Components

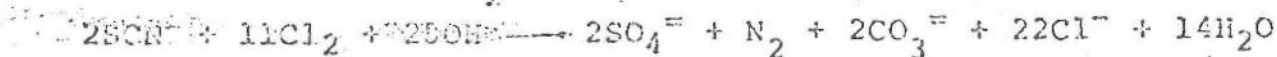
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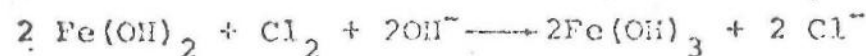
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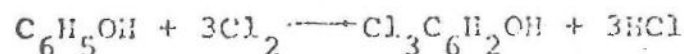


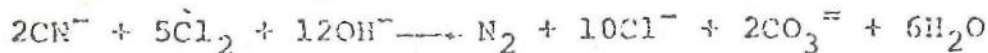
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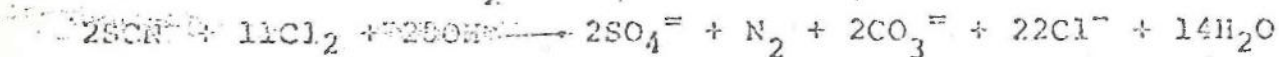
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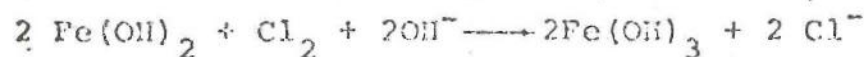
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